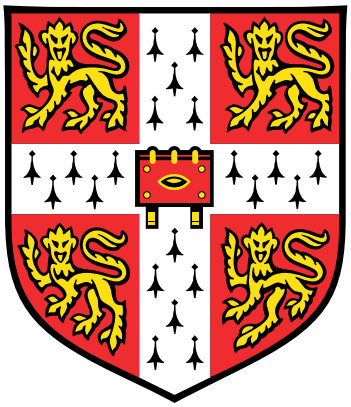
INEQUALITY IN POLITICAL REPRESENTATION



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This dissertation is submitted for the degree of
Doctor of Philosophy

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April 2021

Declaration

This dissertation is the result of my own work and includes nothing which is the outcome of work done in collaboration except as declared in the Preface and specified in the text. It is not substantially the same as any that I have submitted, or, is being concurrently submitted for a degree or diploma or another other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text. I further state that no substantial part of my thesis has already been submitted, or, is being concurrently submitted for any such degree, diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text. It does not exceed the prescribed limit of 60,000 words.

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April 2021

Abstract

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Inequality in Political Representation

In many countries the near-universal right to vote in elections has been a core attribute of their democratic institutions for decades, and in some cases over a century. However, the political experience of many of these very countries over the past decade have often alternated between apathy and frustration in these democratic institutions. Stark economic inequalities have mirrored inequalities in political influence, voters observing that elected officials who determine policy are disproportionately from a political elite or establishment. Why, after decades of near-universal voting rights, are only five percent of MPs in the UK House of Commons from the working class, and only one in four legislators in the United States are women?

There is a growing literature offering empirical evidence that the characteristics of who we elect to office have a significant impact on the policies that are chosen. By implication, persistent inequalities in political representation may lead to policy choices that negatively and disproportionately impact those who are under-represented in politics. Furthermore, the inequalities in representation among politicians are often also seen in other professions, such as among CEOs of high-profile companies. For example, understanding why women are under-represented in politics, as well as the effectiveness of interventions, may provide insight into how to alleviate parallel inequalities in other areas.

The political representation of certain group can be interpreted as a product of supply and demand for their representation. The supply side may be characterised by the decisions of candidates who choose to run for office, the demand side by the voters at elections, and political parties as intermediaries who select candidates to run for them at elections.

I address the political parties as intermediaries in the first chapter, *Learning-By-Losing: Do Political Parties Widen Representation to Win Elections?* In this chapter, I investigate how the incentive to win elections may lead to more inclusive selection by political parties, using the case study of the Conservative Party in the aftermath of their shock landslide defeat in 1906. I argue that political parties may use candidates as targeted instrument to win votes across a variety of constituencies, but that parties may be more likely experiment with different types of candidates following a defeat. Using machine-learning classification and hand-collected biographical information, I find that the Conservative Party responded to a greater defeat in a given constituency by selecting a candidate less associated with the political elite in the following elections in 1910.

The second chapter, *Passing on the Baton: Positive Spillovers from the Olympics to Female Representation in US Politics* focuses on the demand-side factors and the decisions made by voters to elect a female politician. I exploit the timing of the Summer Olympic Games, that are held between primary and general state legislature elections in the United States, to identify the spillovers from female success in one profession (sport) on the decision by voters to elect women. I find evidence of a positive spillover effect from women winning medals at the Olympics on female candidate vote shares in their home state. Although voters do not appear to change their attitudes to women in politics, I find increased discussion of female political representation in the news media, and evidence suggesting that as a result some voters prioritise equality of representation more highly.

Additionally I explore the spillover effects of a woman being elected to office on future female representation, as well as geographical spillovers, in the third chapter *Temporal and Geographical Spillovers in Female Political Representation.* I exploit quasi-random variation in the close election or non-election of women, as well as almost fifty years of state legislature elections. I identify a positive and significant temporal spillover in female representation: initially driven by female incumbents running for re-election, but in the long run driven by new female candidates. In addition, I find evidence of a positive and persistent geographical spillover within a state legislature.

This thesis contributes in several ways to previous research concerning inequalities in political representation, as well as inequalities in other professions. Firstly, I am able to separate different factors that influence political representation, namely the decisions of different political actors, which are masked when merely observing trends

in the proportion of elected politicians from a certain group in society. For example, in Chapter 1 I am able to focus on the decision of political parties in selecting candidates through a novel historical case study, and the impact these decisions have on political representation. A key contribution is that I find evidence suggesting that political parties may use candidate characteristics as a means of winning elections, and its effect on socioeconomic representation among candidates. In Chapter 2 I exploit the timing of a positive shock to female representation between primary and general elections to focus on voters' decisions to vote for female candidates.

Another contribution of the thesis is its investigation of different types of spillover effects in political representation, about which there has been relatively little research. This may be across different professions (as in Chapter 2), geographical areas, or the comparison of temporal spillovers to future elections in the short and long run (Chapter 3). I present evidence of a range of positive spillovers, which have implications for under-represented groups in other professions and policy interventions to address these inequalities.

Further, my application of machine-learning classification to biographical data contributes to potential future research. Previous work largely studies inequalities in one particular dimension (such as gender or race). However, the use of machine-learning classification of candidates in Chapter 1 could be used to investigate inequalities in multiple dimensions. There are many inequalities that one may be concerned about (such as age, gender, nationality, religion, socioeconomic background). The machine-learning classification I use could incorporate rich biographical information concerning all of these characteristics to study changes in and factors influencing inequalities in representation in these labour markets, in the 'political labour market' or beyond.

To my mother Kyung-Hwa, my father Kwang-Hui,
and my brother Ji-Min.

Acknowledgements

First of all, I am deeply grateful to my supervisor Toke Aidt and to my advisor Julia Shvets. Both have always made time to support my academic endeavours, and both have always had the uncanny knack for asking just the right question. Toke's guidance has consistently been served with a healthy dose of good humour, and often, by necessity, patience. I am also indebted to my long-time, and possibly as a result long-suffering, mentor in Julia for so many opportunities ever since she interviewed me for an undergraduate place at Christ's almost a decade ago.

I have undertaken this thesis among a friendly and inspiring cohort of PhD students. I am especially grateful for my academic siblings who make up the rare breed that are political economists: Felix Grey and Alexandru Savu. Further, I have fond memories of the early steps on the PhD journey with Oliver Exton, Athene Laws, and Maarten de Ridder, as well as the welcome comradeship of Michael Ashby, Maryam Vaziri, and Tristan Hennig in the latter stages. The Empirical Microeconomics research group proved a welcoming environment with many who were generous with their time and expertise, such as Sriya Iyer, Meredith Crowley, John Spray, and Christopher Rauh, among many others. I thank Cambridge-INET for providing funding for a research assistant for the first chapter, Paul Aste for his diligent research assistance, and an ever-accommodating administrative support group in Cherie Lee, Silvana Dean, Louise Cross, Craig Peacock, and Nathan Smith.

I am fortunate to have been part of an incredible community of runners, and more importantly friends, in the Cambridge University Hare and Hounds: I now count fourteen of them as former housemates. In particular, I salute Phillip Crout, Peter Cameron, Iain Davies, and Elizabeth Apsley, who were prepared to drop everything to pick me back up at the worst of times, as well as to join in celebrating the best of them. After all, what truly useful wisdom cannot be exchanged while making coffee, in

front of an increasingly eclectic array of televised sport, over an outdoor table tennis table, or during a visit to the Other Place?

Finally I thank my family, whether they are sixty miles away or six thousand. Among many others, they have taught me three important, and complementary, lessons: to take opportunities fearlessly from my father Kwang-Hui, unconditional kindness and resilience from my mother Kyung-Hwa, and the underrated ability to take perspective from my brother Ji-Min.

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Chapter 1

Learning-By-Losing: Do Political Parties Widen Representation to Win Elections?

Abstract

Although the right to vote has long been near-universal in many countries, there are still significant inequalities in political representation. These inequalities have implications for policy choices and speak to labour market inequalities in other occupations outside of politics. One contributing factor may be political parties selecting candidates to win elections. I argue that parties may learn to be more inclusive in their selection in the aftermath of a defeat, through a 'learning-by-losing' process. Using comprehensive hand-collected biographical data and machine-learning algorithms to classify over 2,000 candidates, I find evidence of the Conservative Party choosing candidates from a wider range of backgrounds in response to electoral defeat in the UK 1906 election. I also find evidence of the targeted use of candidate characteristics to win votes.

> 'The demand of the democracy is really for a free choice of doctors. Instead of confining, as it were, those who were able to remedy their evils and cure them to a small class, they say "We want an unlimited choice in picking out those who suit us best".'
>
> David Lloyd George, 10th August 1911[1]

1.1 Introduction

Although the right to vote is near-universal in many countries, and has been so for many years, there still remain significant inequalities in political representation. These inequalities exist over gender, racial, and socioeconomic lines, among others. For example, only two percent of US Members of Congress are from working-class backgrounds, as well as only five percent of MPs in the UK House of Commons, despite making up around half of the population in both countries (Carnes, 2012). However, there have also been recent signs of change. For example, parties may select candidates from a wider range of backgrounds to appeal to a wider set of voters, like the Republican Party in the recent 2020 US congressional elections[2].

Understanding the causes of such inequality in political representation may have implications beyond politics, such as for inequalities in the labour market. A party's decision to select candidates mirrors the decisions made by firms hiring workers and organisations admitting members. Firms may choose to be more inclusive in their hiring for similar reasons that political parties decide to select candidates from a wider range of backgrounds. I suggest that greater inclusivity may be driven by organisations learning from failure.

Further, such inequalities in political representation may have a profound impact on the policies that are chosen. There is extensive empirical evidence suggesting that the characteristics of politicians influences their decisions, whether it be their race (Beach et al., 2019; Hopkins and McCabe, 2012), gender (Bhalotra and Clots-Figueras, 2014; Clots-Figueras, 2011), and socioeconomic class (Carnes, 2012), or even whether they smoke (Burden, 2007), serve in the military (Gelpi and Feaver, 2002), or have

[1] Hansard 10th August 1911 Volume 29 Columns 1365-1477 'Debate on the Payment of Members'

[2] As reported in the New York Times: 'Republican women delivered critical victories to their party in the election, signalling the success of their efforts to recruit and elect a more diverse slate of candidates' on 4th November 2020: www.nytimes.com/2020/11/04/us/politics/republican-women-congress.html

daughters (Washington, 2008). As a result, inequality of political representation may have a significant effect on policy choices and subsequently socioeconomic outcomes, such as inequality.

One important contributing factor to inequalities in political representation may be the decisions made by political parties in their selection of candidates for election. Political parties often have considerable campaigning resources and so have influence over the selection of realistic candidates for election, effectively gatekeepers to public office.

The main contribution of this chapter is to suggest that political parties may be strategic about the types of candidates that they select, and how this influences political representation, of which there is little theoretical or empirical discussion in the economics literature. I investigate whether parties learn from a poor performance and choose candidates from a wider range of backgrounds to win the next election, and focus on the Conservative Party's response to the shock landslide defeat in the UK 1906 General Election. While examples of parties using candidate profiles to win elections are commonplace, this setting allows for the identification of the influence of electoral incentives on a party's choice of candidates.

I also exploit a comprehensive range of candidate characteristics, which I hand-collect not only from the biographies of MPs but also unsuccessful candidates. These characteristics include information about the backgrounds of these candidates including their education, their family's backgrounds, their previous occupations, their social connections, clubs and hobbies, and so on.

In addition, I implement machine learning algorithms (Support Vector Machine and Latent Dirichlet Allocation) in a novel application: to sort candidates into different socioeconomic groups. This reduces the prior judgement required and ambiguity in the identification of candidates as political elites (for example those families have a long history of involvement in politics) or outsiders (such as the working class), or somewhere in between.

I use geographic variation in the Conservative vote share and control for the party's past performance and past candidates. I find evidence that the greater the defeat, the more likely the Conservatives were to switch from candidates from the political elite to those from working-class backgrounds. In the average constituency, a one standard deviation increase in the Conservative defeat margin in 1906 is associated with a decrease of

7.9-10.0 percent in the likelihood that the candidate in 1910 is from the political elite. The same increase is associated with a 19.3 percent increase in the likelihood of the Conservative candidate being from the working class.

This effect is largely driven by the replacement of candidates who lost in 1906 rather than replacing incumbent MPs in the subsequent 1910 elections, further supporting a learning-by-losing explanation. In addition, the Conservatives switched away from the political elite more aggressively in constituencies where they had traditionally performed well, where a given margin of defeat would have been perceived as a greater shock than in other constituencies. Further, this switching is more prevalent and aggressive in working-class constituencies. This is consistent with parties using candidates as a targeted instrument to win votes, as explained in the conceptual framework. Finally, I find that this targeted switching was beneficial to the Conservatives in the subsequent elections in 1910.

Contributions to the Literature I primarily contribute to the literature analysing political under-representation of different groups in society, and especially the causes of such under-representation. There is relatively little work exploring political representation across different socioeconomic groups, such as the working class. Carnes (2012) finds that working-class legislators in the US House of Representatives tend to mirror the economic preferences of working-class voters. In addition, their exclusion from legislatures fuels distrust of political institutions (Barnes and Saxton, 2019) and decreased political engagement (Heath, 2018). As for why there are relatively few politicians from poorer socioeconomic backgrounds, Carnes (2016) argues that the limiting factor is not lack of qualifications or any other supply-side issue, but political parties' low demand for candidates from a wider range of backgrounds. Further, initiatives to increase supply, such as increases in politicians' salaries, in fact crowd out the working class as it increases the supply of middle and upper class candidates (Carnes and Hansen, 2016). I also contribute to a wider literature concerning the representation of historically under-represented groups in politics, such as women and ethnic minorities. There is a considerable body of work that investigates both the causes of such under-representation, such as the bias of voters (Bhalotra et al., 2018; Fulton, 2012; Kahn, 1996) and political parties (Anastasopoulos, 2016; Folke and Rickne, 2016; Sanbonmatsu and Dolan, 2009), as well as the consequences of under-representation of women (Bhalotra et al., 2018; Catalano Weeks, 2019; Clots-Figueras, 2011, 2012) and ethnic minorities (Beach et al., 2019; Hopkins and McCabe, 2012) in politics.

I add to the literature by proposing and finding empirical evidence for a different factor impacting political representation of traditionally under-represented groups: electoral pressures, where parties feel they need to select candidates from a wider range of backgrounds to win an election. In addition, the relatively fixed supply of candidates from non-elite backgrounds allows for the identification of parties' demand for wider representation among its candidates. Focusing on the demand-side decision of parties selecting candidates disentangles the supply and demand for political representation that the literature generally struggles to pull apart. Further, I use machine-learning algorithms on comprehensive bibliographical data. As opposed to the literature which focuses on one characteristic of a candidate (for example gender or occupation), I use a wide array of characteristics to indicate whether a selected candidate part of the political elite or not.

Secondly, I contribute to the literature that discusses the link between political participation and policy, and more specifically whether wider political participation leads to more egalitarian policy. Wider political participation may mean extending the suffrage as well as increasing political participation among those already eligible to vote. Downs (1957) and Meltzer and Richard (1981) argue that the composition of the electorate may have direct implications for policy, the latter suggesting that if the franchise is extended to those with lower incomes there may be greater appetite for redistribution. Various work has suggested that the extension of the franchise has a positive influence on redistribution (Aidt et al., 2006; Aidt and Jensen, 2013; Boix, 2003; Kotera and Okada, 2017), confirming the logic of Meltzer and Richard (1981). Indeed there is more recent evidence of how political participation of other groups may influence policy: Jensen and Yntiso (2019) find that the Jim Crow Laws leads to a larger decrease in social spending in counties with a greater African-American population, while Bertocchi et al. (2020) find an increase in youth participation at elections, through preregistration laws, is associated with greater public spending on education. However, Aidt et al. (2020) exploit structural breaks in fiscal policy and suffrage in the United Kingdom and find little evidence of a link between franchise extension and fiscal expansion.

I contribute to this literature by providing a stepping stone between wider political participation and policy changes: political representation. I argue that even if wider political participation may increase *demand* for, say, more egalitarian policies, if it is not matched by an increase in *supply* of those policies by political parties there may be little change in policy. Given the significance of politicians' characteristics on

their decision-making, wider political participation may only have a meaningful impact on policy once there is wider representation among politicians. As I find, elections may accelerate this process by putting pressure on parties to choose candidates from a wider range of backgrounds. Therefore this is also a contribution to the literature concerning political competition, for example Downs (1957) and Lindbeck and Weibull (1987). While these papers argue that political parties compete using policy platforms, I suggest that they may also compete with the portfolio of candidates that they select, which they can adjust more finely at the constituency level than policy platforms at the national level.

Chapter Layout The chapter proceeds as follows: Section 1.2 explains the conceptual framework from which the empirical strategy is motivated; Section 1.3 outlines the relevant institutional context surrounding the 1906 election and the Conservative response. Section 1.4 describes the comprehensive electoral and biographical information collected; Section 1.6 explains the baseline empirical strategy as well as the machine learning algorithms that sort the candidates into socioeconomic groups (Support Vector Machine and Latent Dirichlet Allocation); Section 1.7 reports the baseline results. Section 1.8 reports further evidence of learning-by-losing; Section 1.9 shows the effect of this strategy on outcomes in the 1910 elections; Section 1.10 concludes.

1.2 Learning-By-Losing: Using Candidates to Win Elections

In this section, I provide a conceptual framework motivating why political parties may use their portfolio of candidates, and their characteristics, as a targeted instrument for winning elections. I then argue that political parties may change the portfolio of candidates as a result of losing an election, which may widen representation among their candidates. This provides motivation for the empirical strategy outlined in the following sections.

1.2.1 Why do voters care about candidates?

A candidate's profile or characteristics may influence electoral outcomes for two reasons. The first is that voters may feel more positively about a candidate who shares some characteristics with them. This may even be independent of the policy platform of

the party that they represent. This is consistent with social identity theory from the political science literature (Ashforth and Mael, 1989; Conover, 1984; Shayo, 2009; Tajfel, 1974) as well as recent empirical work, for example Ansolabehere and Puy (2016). The concept of identity has also been discussed in the economics literature (Akerlof and Kranton, 2000; Besley and Persson, 2019), where voters may choose a candidate or party even if it is not in their economic interests to do so.

Secondly, voters may observe the characteristics of a candidate as a commitment to future policy on behalf of the party that chose them. For example, if a party chooses a candidate from the working class to run for office, it may be a signal to voters that the party intends to propose policies that are more favourable to the working class in the future. There is empirical evidence suggesting that the characteristics of a politician may influence their policy preferences (Bhalotra and Clots-Figueras, 2014; Clots-Figueras, 2011; Hopkins and McCabe, 2012). If a voter observes a candidate with similar characteristics to them, they may interpret this as a sign that the party they represent are more likely to choose policies that benefit them in the future.

This may be the case irrespective of current policy platform. A party may not be able to credibly change policy platform radically, so a change in candidate profiles may be a commitment device for a different policy platform. For instance, a party may choose a working-class candidate to show its commitment to working-class causes in the future, as changing the manifesto to include more economic redistribution may not be credible as such promises may be undone overnight[3]. This is amplified in the case of a significant incumbency advantage (Hainmueller et al., 2015; Lee, 2008), where choosing a candidate opens the possibility of that candidate being re-elected in the future, so is a credible long-term commitment.

1.2.2 Using candidates to win elections

Parties may take advantage of voter preferences by adjusting their portfolio of candidates across constituencies. Further, this may be a targeted instrument that can be adjusted to win votes from different types of voters. The political economics literature focuses on parties changing their platforms to win elections (Downs, 1957; Lindbeck and Weibull, 1987), I argue that the portfolio of candidates is another part of their strategy.

[3]This is similar to the logic of Acemoglu and Robinson (2000) and the threat of revolution theory of democratisation.

Further, changing the portfolio of candidates may be a more targeted instrument of winning votes across constituencies than the policy platforms. A policy platform may be a national manifesto that is delivered across the country. In this case, a change in the policy platform may lose some votes as well as win others. However, there may be an opportunity for parties to change individual candidates and attenuate the negative spillovers of placating one set of voters.

This provides the motivation for political parties to use the portfolio of candidates to maximise their vote shares across many constituencies. Even if the policy platform can be somewhat tweaked geographically, there will be an incentive to use candidates as a more targeted instrument so long that the negative spillovers of changing a candidate in one area on votes won in other areas relatively low. This seems reasonable as voters are likely to care more about the candidates running in their own constituency than candidates running in other constituencies, even those nearby.

1.2.3 Learning-By-Losing: Empirical Motivation

While political parties may choose their portfolio of candidates to maximise electoral success across many constituencies, they may also do this by a learning process than spans across elections[4]. Even if they have complete information about the characteristics of their candidates, they may have imperfect information about voters' preferences. For example, they may not have perfect information about voters' preferences for a certain types of candidates.

As a result, political parties may undergo a learning process that may be characterised as 'learning-by-losing'. A party chooses a portfolio of candidates before an election. If the party performs well at the election, they may choose a similar portfolio of candidates for the next election. However, if they perform poorly, they may make changes.

The economics literature concerning experimentation by individuals (Keller et al., 2005) and groups (Gieczewski, 2021; Gieczewski and Kosterina, 2020; Strulovici, 2010) suggests that they may tend to 'under-experiment', whether due to risk aversion or free-riding from others' experimentation. If political parties also exhibit this consistent under-experimentation, it may take especially poor election results for them to finally experiment.

[4]They may also change their policy across time, but I focus on changes to the profiles of candidates. Further, I argue in the previous sub-section why political parties may prefer to change the portfolio of candidates rather than the policy platform.

A political party may therefore change the type of candidate in a constituency in response to a poor result in that constituency. The greater the defeat (compared to what was expected), the greater the signal to the party that they should change their strategy. If this is the case, one would expect that a poorer performance in a constituency in one election should make changing the type of candidate at the next election more likely. One may expect that a result of this learning-by-losing process could result in the selection of candidates from a wider range of backgrounds, especially if the party were initially choosing from a relatively narrow selection of characteristics.

1.3 Political Representation and the Landslide 1906 Election

In this section I outline the relevant political and historical background of British politics between 1900 and 1910. I briefly describe the political institutions, as well as the historical context of the four elections between 1900 and 1910. I explain why the shock landslide defeat of the Conservative Party in 1906 provides an ideal setting to isolate the decision of the party to select candidates from a wider range of backgrounds in response to the electoral defeat.

1.3.1 Landslide Conservative defeat in 1906

By the beginning of the twentieth century, British politics had been dominated by two political parties (the Conservatives and the Liberals) for decades. Partly helped by the early popularity of the Boer War, the Conservatives won a large majority of 130 seats (in a House of Commons of 670 members[5]) at the 1900 election. However, the 1906 election saw the Conservatives lose 246 seats in a landslide defeat that left even the Prime Minister Arthur Balfour without a seat in Parliament. As Blewett (1972) suggests, this landslide defeat was the result of a perfect storm of frustration in the Boer War and more general concerns over poverty across the United Kingdom, emphasised by an embryonic trade union and Labour Party movement. Further, the Rowntree Report in 1899 brought the scale of poverty among the working class to the attention of the political elite and the middle class, as well as reports that forty

[5]The United Kingdom Parliament is made up of two legislative chambers: the House of Commons which is made up of elected officials, and the House of Lords which is made up of appointed and hereditary peers.

percent of recruits for the Boer War were so malnourished and unhealthy that they were deemed physically unfit for war. Sykes (1998) suggests that the Conservatives viewed the primary factor behind the landslide defeat in 1906 was 'the desertion of the Conservative working-class voter.' The next few years would see unprecedented redistributive policy under a Liberal government, which saw the introduction of a welfare state system[6]. In contrast, the Conservatives opposed these policies, as they had done in 1906, emphasising the trade-off between a welfare state and Britain's ability to fund its army and navy. The Conservative-dominated House of Lords rejected the 'People's Budget' of 1909, and the Liberal government were forced to hold not one but two elections in 1910: the first in January to show support for the Budget, while the second in December was later called to show support for removing the House of Lords' ability to reject budgets.

1.3.2 Elections in Britain 1900-1910

The House of Commons throughout the four relevant elections (1900, 1906, January 1910, and December 1910) consisted of 670 members. The vast majority of Members of Parliament (MPs) were the sole representative of their constituency, with a minority of constituencies represented by two members. In single-member constituencies, political parties would select one candidate for the general election. As Blewett (1972) notes, the central party organisation had considerable influence over the selection of candidates, in particular through campaign funding.

1.3.3 Why Focus on the 1906 Election?

The shock landslide election in 1906 provides a unique opportunity to focus on the choice of the party in selecting candidates from a wider range of backgrounds: firstly the unexpected nature of the 1906 election result, and secondly the Conservatives' highly centralised process of selecting candidates. These suggest that changes to the type of candidates run in 1910 would be the result of the Conservatives learning from

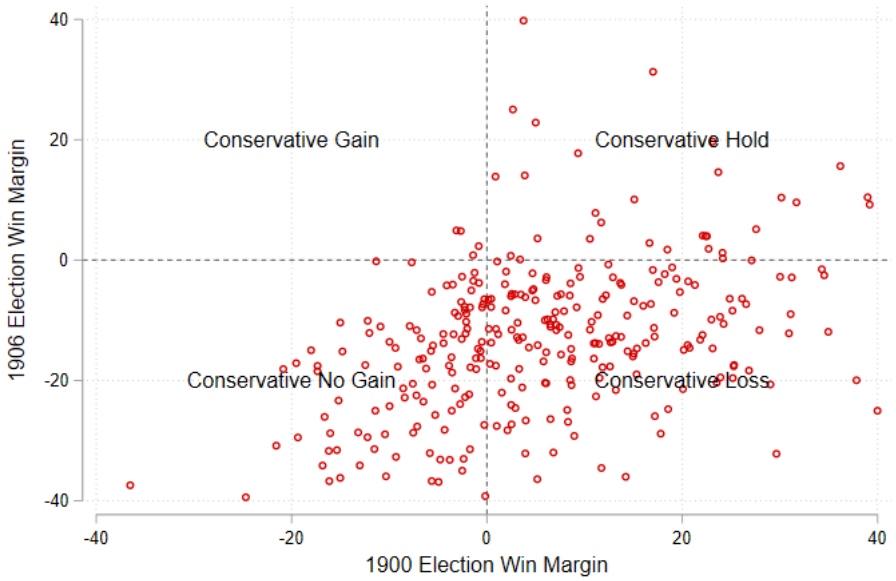
[6]The Liberals introduced a raft of unprecedented welfare policies: the Education Act (1906) providing new free school meals; the first nationwide state pensions and unemployment insurance were introduced in the Old Age Pension Act (1908) and the National Insurance Acts (1911); the Trade Boards Act (1909) set minimum wages in some trades; job centres were set up in the Labour Exchanges Act (1909); notably the Trade Disputes Act (1906) was the first significant legislation that provided labour unions some protection from their employers when striking.

the 1906 election and selecting from a wider range of backgrounds to do better in the 1910 elections.

Unexpected shock of the 1906 landslide

The first advantage of this setting is the unexpected result of the 1906 election. The Conservatives lost 246 out of their 402 seats (in a 670 seat House of Commons), after eleven years of dominance. The popularity of the Liberal Party's policy of radical redistribution was unexpected at the 1906 election, despite the Boer War and the Rowntree Report highlighting the extent of poverty within the United Kingdom[7]. However, this was also a landslide that was indiscriminate across regions and socioeconomic classes, in constituencies where they had previously been popular as well as those where they were unpopular[8].

Fig. 1.1 Conservative 1906 and 1900 Election Results across Constituencies



[7]The Rowntree report in 1899 brought the scale of poverty among the working class to the attention of the middle class, while the Boer War (1899-1902) shone a disturbing light on the health (or lack of) of the country: 40 percent of recruits were determined unfit for duty. Although there were many other reasons for the Conservative defeat in 1906. Blewett (1972) provides a more detailed explanation of the political timeline.

[8]This is illustrated by the fact that the swing against the Conservatives in 1906 was 12.2 percent of the vote among predominantly upper class constituencies; 11.7 percent among middle class constituencies; 13.1 percent for working class constituencies.

This is presented in Figure 1.1, which reports the Conservative win margin (as a proportion of total votes) in 1906 compared to that of 1900. This election result was also a shock. All but three of the Conservative cabinet lost their parliamentary seats, including Prime Minister Balfour himself. Had the margin of defeat been known, it seems likely that more resources would have been thrown into assuring the re-election of significant Conservative Party members. Unlike in the previous century, there had been no recent extension of the franchise to new voters. Further, the swing away from the Conservatives in 1906 (5.4 percent of total votes) was unprecedented in British politics.

Opinion polling before the election was virtually non-existent in the early twentieth century, with politicians relying on often idiosyncratic results of by-elections instead, limiting the ability of the Conservatives to anticipate the result. This is echoed by the response to the result, with The Times reporting that the Liberals '*will realise all that they dreamt and hoped for, but scarcely ventured to expect ... about to suffer an embarrassment of riches.*'[9] This election result, in its magnitude and unexpectedness, provide an ideal quasi-exogenous shock to the Conservative's selection of candidates in the subsequent elections.

Strong party control over candidate selection

The second advantage of this setting is the relatively fixed supply of candidates from non-elite backgrounds, with selection controlled by the central party. As a result, one can focus on the demand-side decisions of the party in response to election results. Before the Parliament Act of 1911, Members of Parliament (MPs) are not paid and therefore required to pay their own expenses, as well as a large proportion of their campaign funding (Blewett, 1972). Even if more candidates from non-elite backgrounds wanted to run for office in light of the 1906 election, they would not be able to do so unilaterally: the supply of candidates from non-elite backgrounds is relatively fixed. The average candidate in a contested seat spent £1,100 in campaign financing (Blewett, 1972), while the average annual income in the United Kingdom in 1900 was £46.64 (Allen, 1994). Candidates from non-elite backgrounds therefore rely on central party funding decisions, such as the £13,940 spent by the Conservative Party on working-class candidates in the 1910 elections.

[9]The Times Newspaper, 16th January 1906.

If the result of the 1906 election prompted the selection of candidates from a wider range of backgrounds, it is likely the consequence of increased *demand* for non-elite candidates from political parties rather than *supply* through non-elite candidates bankrolling themselves.

Overall, the 1906 election provides an opportunity to interpret a change in candidate selection as a result of the Conservatives learning from losing the 1906 election. This setting provides a unique opportunity to identify political party's decisions in selecting candidates to try and win elections.

1.4 Descriptive Summary of Electoral and Biographical Data

1.4.1 Electoral and Constituency Data

The unit of observation is a party-constituency-election (for example, the Conservative Party candidate for the City of London constituency in the 1906 General Election). The 3,938 party-constituency-election combinations cover four UK general elections (1900, 1906, January 1910, and December 1910) in constituencies in England, Scotland, and Wales.

The electoral data is extracted from Craig (1974) *British Parliamentary Election Results: 1885-1918*. This provides the names of candidates (in some cases their title), their party, the number of votes for each candidate, and the rate of turnout. Summary statistics about the elections can be found in the Appendix A.1, but the most important aspect of the electoral data is documenting the extent of the Conservative loses in 1906 (compared to 1900). In addition, information about constituency characteristics is taken from Blewett (1972), which is presented in Table 1.1.

1.4.2 Biographical Data

I hand-collect biographical information concerning not only concerning those who won election to the House of Commons between 1900 and 1910, but also the vast majority of unsuccessful candidates. This provides a wider insight into whether the Conservative party opened its doors to those outside of the establishment than only focusing on those who were elected.

Table 1.1 Constituency Characteristics

Population	68,377
Number of Houses	13,047
Urban	48.8%
Predominantly Upper/Middle Class	13.3%
Mixed Classes	24.6%
Predominantly Working Class	22.6%
Mixed Urban/Rural	12.0%
Mining Community	2.3%

Notes: This table reports summary statistics concerning constituency characteristics, either as the mean value across constituencies (population and number of houses) or as a percentage of constituencies that match the description according to Blewett (1972).

This data is compiled primarily from two biographical dictionaries. The first is *Who's Who of British Members of Parliament* (Stenton and Lees, 1979), which provides summarising biographies of Members of Parliament from 1832 to 1945. This provides information not only about those who sat in Parliament between 1900 and 1910 (which is the period of interest in this chapter), but also those who ran unsuccessfully in that period and succeeded before 1900 or after 1910. The second is the *Oxford Dictionary of National Biography*, which covers many unsuccessful candidates who played a significant role in society in other ways. Combined, these sources contribute information on 2,245 candidates across the four elections between 1900 and 1910.

The full extent of the biographical data can be explored in the Appendix A.1.1, but the main characteristics of each candidate are their titles (honorary, military, hereditary); their education (school and university); their previous occupations before running for office; the occupations of their family members (often their father and father-in-law's). In addition, there is data on their social connections, which illustrates to what extent the candidate was well connected to the political or social establishment. This information includes all of the social clubs they were members of; what law houses they practised at; the number of connections with other candidates in the sample they had by virtue of their school, university, law houses, and social clubs; whether they were appointed Justice of the Peace[10]. Using this wealth of information I am able to assess whether the Conservative party selected candidates in 1910 who were very different from those in 1906, as well as identify those who are from the political elite/establishment.

[10]This title implied they had many connections in the local area they were appointed a JP for.

There are inevitably some limitations associated with the data. The most important is the lack of data for 10.7 and 11.5 percent of all and Conservative candidates, respectively[11]. I discuss the potential impact of missing biographical data in Appendix A.6.4. I report results for a wide range of assumptions about those with missing biographical data, and still find similar results. Another issue is the incidence of two-member constituencies, such as Plymouth and Cambridge University, as it is unclear what the margin of loss is for a candidate or party, but this is only the case for 23 constituencies. Furthermore, biographical data is scarce for the Irish MPs (and more so for candidates in general), so their 103 constituencies are removed.

1.5 Machine-Learning Classification of Candidates

In this section I provide motivation for the novel use of machine-learning to classify candidates. I outline the procedures of two methods the Support Vector Machine (SVM) and the Latent Dirchlet Allocation (LDA). These provide estimated probabilities that a candidate is a member of a particular socioeconomic group (for example the political elite), fully exploiting the wealth of hand-collected biographical data.

1.5.1 Machine-learning and candidate classification

While there is a wide range of biographical data available for each of the candidates, I aggregate this information using two different machine learning methods: a Support Vector Machine (SVM) and Latent Dirichlet Allocation (LDA).

Support Vector Machine (SVM)

The first method I use is the Support Vector Machine, which has been used in various scientific fields, such as bioinformatics (Manavalan and Lee, 2017) and brain image classification (Zhang et al., 2015). In economics, Gründler and Krieger (2016) use a support vector machine to compile a democracy index using a range of variables, while Ghoddusi et al. (2019) discusses its popularity in predicting energy prices and consumption.

[11] 10.7 percent of all party-constituency-election trios and 11.5 percent of Conservative constituency-election pairs.

An intuitive explanation (a technical discussion can be found in Cortes and Vapnik (1995) and Gründler and Krieger (2016)) of the support vector machine process is as follows:

1. Label candidates who are unambiguously part of the political 'elite' or unambiguously 'outsiders'.
2. Assign Elite (SVM)=100 to those labelled as 'elite' and Elite (SVM)=0 to those labelled as 'outsiders'.
3. Use a support vector machine to find an optimal hyperplane that maximises the distance (within the space of all characteristics besides those used to label the unambiguous cases) between itself, the 'elite', and the 'outsiders'.
4. Use this hyperplane to categorise unlabelled candidates (continuously from 0 to 100).

For the initial labelling, I define those who are unambiguously 'elite' as candidate who have both a hereditary title in their family and a member of their family who is involved in politics, which labels 6.7 percent of the observations. This is likely to well identify the pinnacle of the political elite, as these candidates are likely to have connections to both the House of Commons and the House of Lords. I define those who are unambiguously 'outsiders' as those whose families were traditionally manual workers/labourers, which labels 9.0 percent of the observations. These families are highly unlikely to have a previous connection with Westminster politics - especially as the trade union movement had only just begun to involve themselves in Westminster politics at the turn of the century. While initial labelling is inherently somewhat arbitrary, I believe this labelling is justified by the historical context. Furthermore, in Appendix A.6.1 I alter the labelling assumptions about the unambiguously elite and outsiders which show the robustness of the following results. The following results use the continuous form of the estimated **Elite (SVM)** variable.

Latent Dirichlet Allocation (LDA)

To support this analysis, I also use Latent Dirichlet Allocation. This unsupervised machine learning topic model clusters text into a number of topics, which has been used to analyse text in a variety of scientific settings, such as grouping medical studies (Wu et al., 2012). Latent Dirichlet Allocation has also been recently used in

economics to analyse the transcripts of the Federal Reserve's Open Market Committee to analyse transparency in policy-making decisions (Hansen et al., 2018), CEO behaviour (Bandiera et al., 2020), and political ideologies among voters Draca and Schwarz (2019). While a thorough explanation of the method can be found in Blei et al. (2003) (and its implementation by Bandiera et al. (2020) who explain its advantages over other methods such as k-means clustering[12]), the following is a more intuitive explanation.

The LDA finds clusters of candidates across the space of characteristics, where the number of clusters is specified. The LDA then estimates the probability that a candidate is a member of one of the groups represented by the clusters. For example, one cluster might be one where those whose families have hereditary titles may also be more likely to go to Eton and then Oxford or Cambridge. Although the number of clusters are specified, the groups returned and their characteristics are not. I assume three groups[13], but in the Appendix A.6.3 I allow for different number of groups and find similar results[14].

The LDA is agnostic about the nature of the groups it presents, so I present three word clouds that provide some intuition. Figure 1.2 presents word clouds from each of the three groups where the size of the word is weighted according to the number of members[15] who have that characteristic. Candidates who are likely to be members of Group 1 have families with hereditary titles, went to fee-paying schools and went to Oxford or Cambridge for university - potentially the political elite. Likely members of Group 2 also are likely to go to Oxford and Cambridge, but have occupations more focused on the professions, such as law, the civil service, and academia - potentially the middle class. Finally, the likely members of Group 3 are overwhelmingly those who were, as well as their family, skilled labourers - likely the working class.

As a result, I interpret the probability of a candidate being a member of group 1 as being the probability that they are a member of the political elite, and likewise for group 2 (middle class) and group 3 (working class).

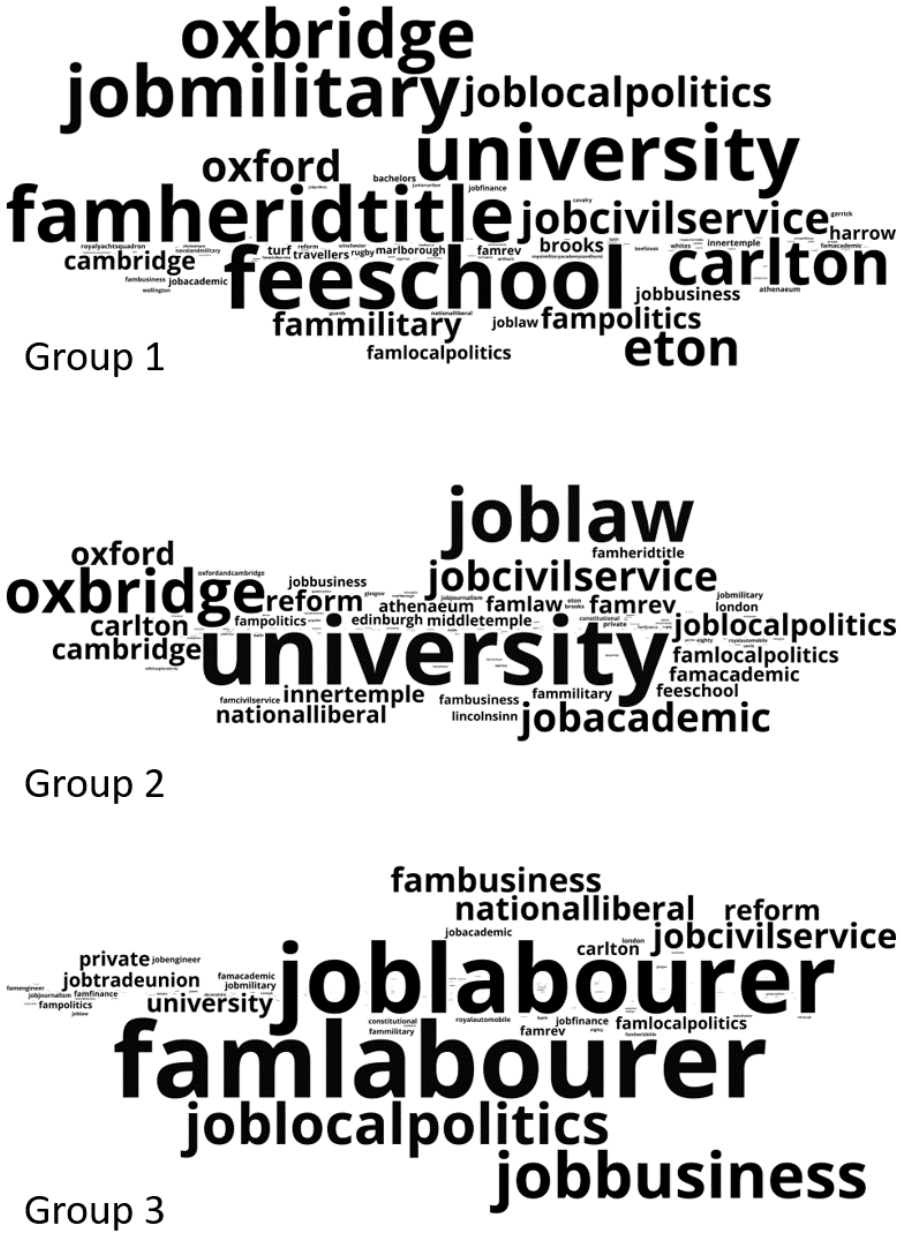
[12]In Appendix A.6.2 I use k-means clustering and find similar results

[13]The social class hierarchy of Britain in the early twentieth century also provides motivation for initially choosing three groups with the notion of an upper class, middle class, and working class (Blewett, 1972).

[14]The driving force behind this robustness is the distinctive clustering of those who have hereditary titles into one group and those whose families are labourers into another, even for larger group sizes.

[15]Members being defined as candidates whose probability of being in that particular group is greater than any of the other probabilities of being in one of the other groups.

Fig. 1.2 Word Cloud of Common Characteristics



This figure presents a word cloud of common characteristics within the three groups

Elite Index Variables

The two algorithms estimate probabilities between 0 and 100 of a candidate being a member of a group:

1. **Elite (SVM)**: Probability that the candidate is in the political elite, according to the SVM.
2. **Elite (LDA)**: Probability that the candidate is in the political elite, according to the LDA.
3. **Middle (LDA)**: Probability that the candidate is in the middle class, according to the LDA.
4. **Working (LDA)**: Probability that the candidate is in the working class, according to the LDA.

Elite (SVM) provides an indication of switching between candidates from the political elite to those further away from the political elite, whether it be the middle class or the working class. The variables estimated by the LDA may illustrate more nuanced patterns of switching between the political elite to the middle class, the middle class to the working class, and so on. I use all four of the estimated probabilities as dependent variables in the main analysis.

1.5.2 Advantages of the LDA/SVM over other classification methods

The main advantage of using these machine learning algorithms is that it reduces prior judgement required in the classification of candidates. Manual classification of candidates would either be somewhat arbitrary or make assumptions about whether a certain characteristic belongs to one group or another. While some candidates are fairly obviously part of the political elite or the working class, there may be many cases where it is less obvious.

Further, the extent to which a certain characteristic makes a candidate more or less likely to be part of a group may not be obvious. Whereas having family who were involved in politics and have hereditary title may be an obvious characteristic of those in the political elite, whether a candidate was involved in local politics may

not be as obvious an indicator[16]. As argued by Gründler and Krieger (2016), these machine-learning methods with endogenous weighting on different characteristics avoid the problem of arbitrary weighting that other aggregation methods may suffer from, while still making use of the full extent of the biographical data.

The SVM mostly only relies on fairly intuitive labelling of some observations. Further, the LDA only requires the specification of the number of groups, which I vary in the Appendix, especially as I include all characteristics. Draca and Schwarz (2019) outline some advantages of using the LDA compared to other classification methods: firstly that it allows for non-linear relationships between characteristics compared to Principal Component Analysis (PCA) and Factor Analysis (FA) which do not. For example, the LDA would allow for the fact that, given other characteristics, being involved in local politics may be an indicator of being part of the political elite (because they were influential in their local area already) or the working class (because for them it was their primary avenue into politics). Further, compared to k-means clustering and Latent Class Analysis, Draca and Schwarz (2019) argue that the LDA allows for mixed membership - for example 10 percent political elite, 40 percent middle class, 50 percent working class - rather than just a single probability that a candidate was a member of one group.

1.6 Empirical Strategy

I use the following baseline empirical strategy to find whether the Conservatives responded to the electoral shock of 1906 by changing the identity of the candidate for the 1910 elections:

$$y_{i,1910} = \alpha + \beta_1 LossMargin_{i,1906} + \beta_2 y_{i,1906} + \beta_3 LossMargin_{i,1900} + \epsilon_{i,1910}, \quad (1.1)$$

where $y_{i,1906}$ and $y_{i,1910}$ are values of the outcome variable, which is the probability that the Conservative candidate in constituency i is a member of a certain group which is a certain characteristic, in the 1906 and the 1910 elections, respectively; $LossMargin_{i,1906}$ and $LossMargin_{i,1900}$ are the margins by which the Conservative party lost the election in constituency i in the 1906 and the 1900 elections, respectively.

[16]For example, the political elite may be involved in local politics because they are influential in their local area, whereas local politics may also include those from working-class backgrounds who were elected to local councils.

I define the variable by the loss margin so that the explanations of the results are more intuitive: for avoidance of doubt I also include observations with negative values of $LossMargin$ (where the Conservative won).

I include $y_{i,1906}$ so that β_1 can be interpreted as the effect of the 1906 election on candidate characteristics in 1910 *relative* to the candidate in 1906. The coefficient of interest is β_1 - this estimates how much the Conservative party candidate changed for the 1910 elections in response to electoral failures in 1906. I also include $LossMargin_{i,1900}$, so that the variation across constituencies is how poorly the Conservatives did *relative* to their past performance in 1900. One would expect that, if the Conservatives lost by the same margin in two constituencies, the shock would be greater in the constituency where historically they had performed well. This is robust to other controls for previous Conservative performance, such as how many elections the Conservatives won in the constituency between 1885 and 1900. The treatment group is effectively constituencies where the Conservative lost by a large margin in 1906 relative to their previous performance in 1900, the control is a loss margin in 1906 that is not as large relative to 1900, compared to other constituencies.

Another reason for including $y_{i,1906}$ and $LossMargin_{i,1900}$ is to control for unobserved constituency heterogeneity. While the 1906 election was a shock to the political elite, the geographical variation in this electoral shock, the variation in the Conservative loss margin, may not be exogenous (although Figure 1.1 suggests that heavy losses were experienced across seats with a wide range of 1900 performances). For example, the $LossMargin_{i,1906}$ may be low in constituencies where the Conservatives have previously performed well, which may be associated with long-incumbent Conservative MPs who are more likely to be part of the political elite. I include these controls in the remainder of the chapter (estimating standard errors clustered at the constituency level), and Appendix A.5 reproduces these results without controls which lead to similar conclusions.

1.7 Results

In this section I report the baseline results, which provides evidence of the Conservatives responding to the 1906 election by switching representation among their candidates from those in the political elite to those from the working class. I undertake a falsification test which shows that the effect is unique to the Conservatives.

1.7.1 Baseline Results

Table 1.2 reports the baseline results, and illustrates the significant effect of the 1906 defeat on the type of candidates the Conservatives fielded in 1910. Columns 1 and 2 report the effect of the 1906 loss margin on the probability of whether the Conservative candidate in 1910 is from the political elite, as estimated by the SVM and LDA, respectively. Columns 3 and 4 report the same effect on the probability of the candidate being from the middle class and the working class groups as estimated by the LDA.

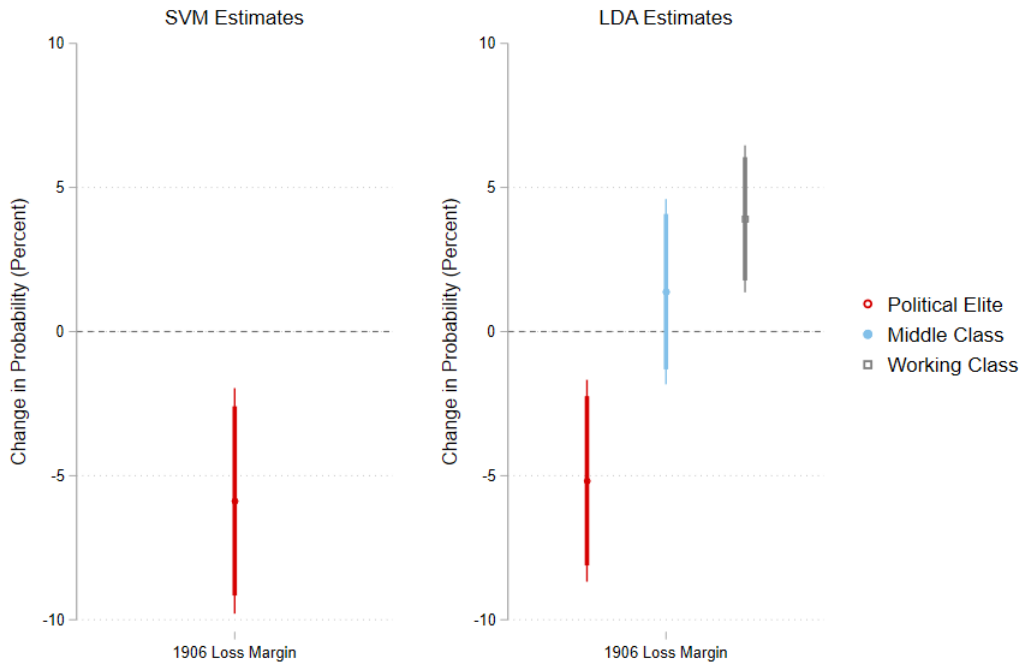
Table 1.2 Baseline Results

	(1) Elite (SVM)	(2) Elite (LDA)	(3) Middle (LDA)	(4) Working (LDA)
1906 Loss Margin	-0.289***	-0.255***	0.068	0.193***
	(0.098)	(0.088)	(0.081)	(0.064)
1900 Loss Margin	0.046	0.009	0.069	-0.070
	(0.096)	(0.086)	(0.078)	(0.062)
Lagged Dependent Variable	0.270***	0.430***	0.351***	0.378***
	(0.044)	(0.041)	(0.047)	(0.041)
Adjusted R^2	0.089	0.205	0.108	0.162
N	468	468	468	468

This table reports the estimates of the effects of the 1906 loss margin in a constituency on the type of candidate the Conservatives select in 1910. The dependent variable in Column 1 is the probability that the candidate is a member of the political elite as defined by the Support Vector Machine. In Columns 2, 3, and 4, the dependent variable is the probability that the candidate is a member of the political elite, middle class, and working class, respectively, as defined by the Latent Dirichlet Allocation. The 1900 and 1906 loss margins are the Conservative losses to the winning party, as a percentage of total votes cast in the constituency (negative if the Conservatives won). The lagged dependent variables are the values of the dependent variables in 1906. Standard errors are reported in parentheses and are clustered at the constituency level. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

Columns 1 and 2 clearly show a significant switching away from political elite. For every percentage point increase in the defeat that the Conservatives faced, there is around a 0.25 to 0.3 percentage point decrease in the probability that the candidate in the 1910 elections was from the political elite. While there is little evidence of switching to middle-class candidates in Column 3, there is significant evidence of switching to working-class candidates in Column 4. These results are also illustrated in Figure 1.3, which illustrate the percentage point change in the probability of the 1910 candidate being a member of a certain group, in response to a one standard deviation (17.3 percentage point) increase in the 1906 defeat.

Fig. 1.3 Baseline Results



This figure illustrates the main results from Table 1.2: the effect of a one standard deviation increase in the 1906 loss margin on the percentage probability that the candidate is from a certain group. Both 90 and 95 percent confidence intervals are illustrated.

Figure 1.3 shows that the one standard deviation increase in the 1906 defeat leads to a 5.9 and 5.1 percentage point decrease in the probability that the candidate is from the political elite, according to the SVM and LDA, respectively. In the average constituency, this is a decrease of 10.0 and 7.9 percent. The same increase in the defeat in a constituency is also associated with a 3.9 percentage point increase in the chances of the 1910 candidate being from the working class, which is an increase of 19.3 percent in the average constituency. The baseline results provide evidence of significant switching of candidates in response to a greater loss in the 1906 election.

I also investigate the effect of the 1906 defeat on the type of candidates the Conservatives fielded in 1910 by focusing on individual characteristics. The results of these are produced in the Appendix, illustrated in Figure A.4. These suggest the same conclusion: an increase in defeat in 1906 is associated with the candidate in 1910 less likely to have characteristics that are intuitively associated with the political elite (such as an Oxbridge education), and more likely to have characteristics associated with the

working class (such as having a father who was a manual labourer). The following results in the remainder of the chapter, which use the estimated SVM/LDA probabilities as the dependent variable, are also robust across individual characteristics, as reported in Appendix A.4.

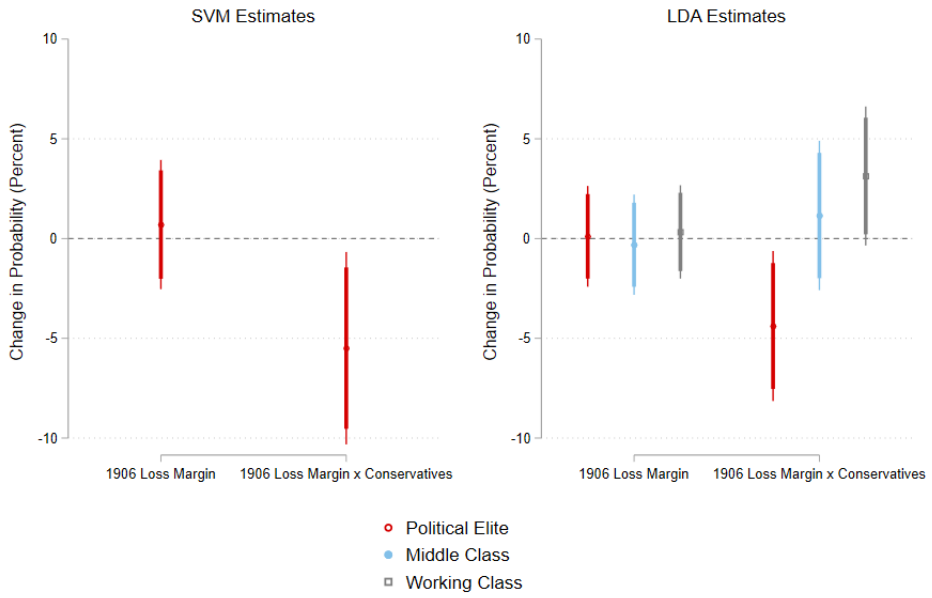
1.7.2 Falsification Test - Effect Unique for Conservatives?

There is historical evidence suggesting that the other significant political party, the Liberals, had more information about voter preferences going into the 1906 election, for example the increased appetite for more redistributive policies (Blewett, 1972). The Liberals had made an election pact with the Labour movement in 1903. After winning the 1906 election they proceeded to enact the introduction of the first ever statewide pensions, unemployment benefits, free school meals, trade union protection, and so on.

Therefore one would expect the 'learning-by-losing' process in 1906 and beyond to have been unique to the Conservatives: the historical evidence suggests that an outreach to more working-class voters was a lesson that had been learned already by the Liberals before 1906. As a result, the Liberals provide a falsification test for the Conservative learning-by-losing process. To undertake this falsification test, I include all candidates from all parties (which also includes some Labour candidates among other smaller parties), and define the loss margin as the loss margin for the party that selected the candidate. In addition, I include an interaction between the 1906 loss margin and a dummy variable indicating whether the candidate is from the Conservative Party or not.

The results are shown in Figure 1.4. The right-hand side illustrates the Conservative switching of candidates from the political elite to the working class in response to a greater loss, as in Figure 1.3. The left-hand side of Figure 1.4 confirms that this response to a greater loss margin is unique to the Conservatives. An increase in the 1906 loss margin for the Liberals (and other parties) does not appear to change the type of candidates that they select for the 1910 election. This is consistent with the learning process described above: one where the Conservatives were slower to learn about voter preferences than other parties.

Fig. 1.4 Including All Parties - Unique Effect for the Conservatives



This figure illustrates the main results from Table A.8: the effect of a one standard deviation increase in the 1906 loss margin on the percentage probability that the candidate is from a certain group. Both 90 and 95 percent confidence intervals are illustrated.

1.8 Further Evidence of a 'Learning-By-Losing' Process

This section provides further evidence of a learning process that the Conservatives underwent. I exploit constituency heterogeneity: firstly by the discrete variation in whether the Conservative candidate in 1906 won or not. Secondly, I explore variation in the perception of the defeat. I argue that a large loss in a constituency where the Conservatives had traditionally performed well would have been a greater signal to change strategy. Thirdly, I explore socioeconomic variation across constituencies to investigate whether the Conservatives used candidates as a targeted instrument, as argued in Section 1.2.

1.8.1 Don't Lose, Don't Learn?

I further analyse the learning-by-losing process by investigating switching of candidates in constituencies where the Conservatives were defeated in 1906 and those where the Conservatives won in 1906. I argue that, in a given constituency, the signal for

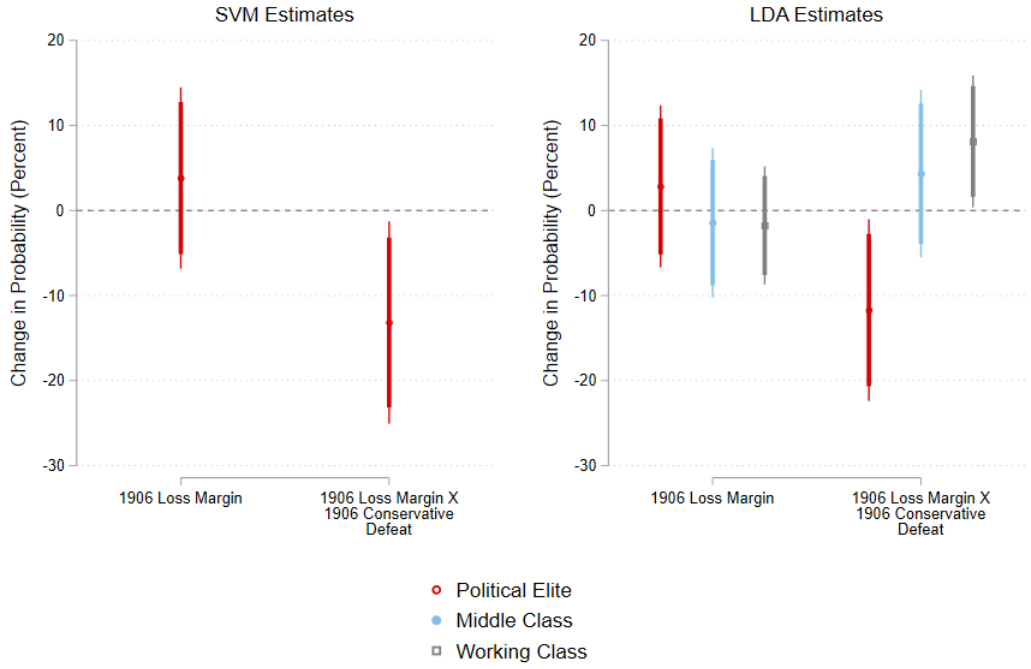
the Conservatives to change their candidate may be the margin of defeat in 1906, controlling for previous performance.

However, one may expect a difference in the learning-by-losing process between constituencies where the Conservatives won and lost in 1906. For example, a given change in the margin may not be perceived as the same strength of signal, depending on whether the Conservatives won or lost the election in 1906. The increase in the loss margin from 10 to 20 may be perceived as a greater signal than the same increase in the loss margin from -20 (where the candidate had previously won by 20 percent) to -10. This may be because the signal may not be perfectly continuous across the loss margin: it is easier for the Conservatives to ignore a decrease in win margin if the candidate remains in the House of Commons, and less easy for the Conservatives to ignore an increase in the loss margin if that seat is occupied by the Liberals.

Further, this discontinuity in response may be driven by risk aversion, and this may influence how they change their strategy in response to a signal. Even though a candidate has won by a smaller margin in 1906 compared to 1900, the party may be reluctant to uproot the incumbent as the quality and popularity of the alternative candidate is not perfectly known. Even if the signal is just as strong in constituencies where the Conservatives won, they may be reluctant to change strategy when at the very least the current candidate was elected into the House of Commons. To test this, I include an interaction between the 1906 loss margin and a dummy variable indicating whether the Conservatives lost the election in the constituency in 1906 (as well as the dummy variable alone) to the baseline specification.

Figure 1.5 illustrates the results, which show that the switching of candidates from the political elite to the working class (and to extent the middle class) is driven entirely by constituencies where the Conservatives lost in 1906, depicted on the right-hand side. While a smaller victory than before does not result in the switching of candidates, a greater defeat results in widening representation. In constituencies where the Conservatives lost in 1906, a one standard deviation increase in the defeat is associated with a 11.2 or 10.0 percentage point decrease in the probability that the candidate is from the political elite (19.0 and 15.5 percent decrease for the average constituency) as defined by the SVM and LDA, respectively. This also increases the probability that the candidate is from the working class by 6.9 percentage points (34 percent for the average constituency). These are significantly larger than the average effect across all constituencies presented in the baseline results. The discontinuity of

Fig. 1.5 Don't Learn Unless They Lose - 1906 Constituency Victory or Loss



This figure illustrates the main results from Table A.9: the effect of a one standard deviation increase in the 1906 loss margin on the percentage probability that the candidate is from a certain group. Both 90 and 95 percent confidence intervals are illustrated.

the effect reduces concerns about the baseline result being driven by long-term changes in preferences across the country.

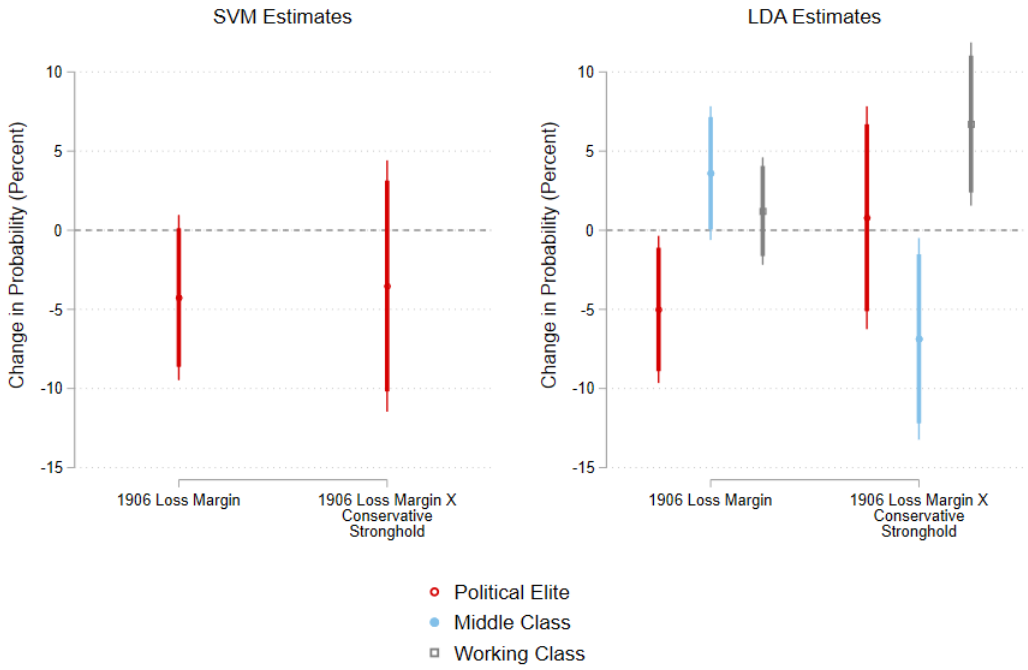
There may be other practical reasons for this discontinuity, such as the party's wish to hold onto an incumbency advantage (Hainmueller et al., 2015; Lee, 2008) or to maintain party unity which may be disrupted by replacing an incumbent politician. However, these results provide evidence consistent with a learning process where the Conservatives do not learn unless they lose.

1.8.2 Conservative Strongholds: A Greater Shock?

I next investigate whether the same defeat (relative to the 1900 result) is perceived as a stronger signal if the Conservatives were historically strong in the constituency. For example, a given defeat may be seen as more concerning if the Conservatives had traditionally performed well in the constituency, as it may have been a long time since the central party had to consider a new candidate for the seat. This stronger signal may

be more likely to result in a change in candidate, as a product of the learning-by-losing process.

Fig. 1.6 Conservative Strongholds and the 1906 Loss Margin



This figure illustrates the main results from Table A.10: the effect of a one standard deviation increase in the 1906 loss margin on the percentage probability that the candidate is from a certain group. Both 90 and 95 percent confidence intervals are illustrated.

I interact the 1906 loss margin with a binary variable indicating whether the Conservatives had won in the constituency four or more times in the five elections before 1906[17] (defined as a Conservative stronghold) or not. This is a good measure of how comfortable the Conservatives were in that seat, and therefore how much of a shock a given 1906 result was perceived.

The results presented in Figure 1.6 suggests that there was more aggressive switching of candidates in Conservative strongholds than in others. The left-hand side of Figure 1.6 shows the effect of the 1906 loss margin on other constituencies, and suggests switching from the political elite to the middle/working class. However, the right-hand side shows more aggressive switching: not only some evidence of switching from the political elite to working-class candidates, but also switching away from middle-class candidates.

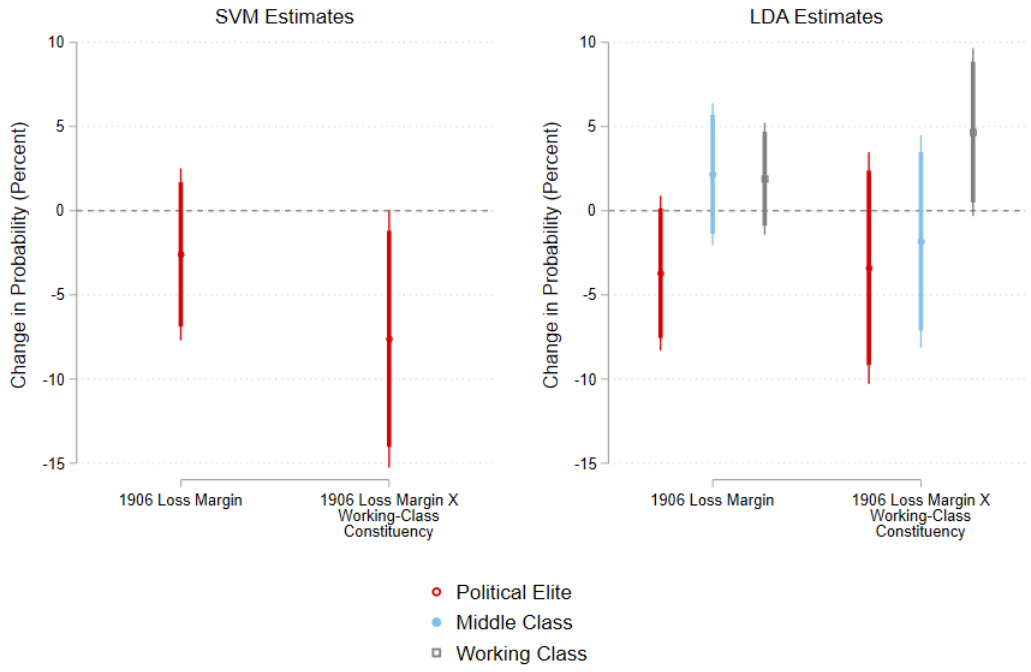
[17]Elections before 1885 were contested on different constituency boundaries.

These results are consistent with a learning process where the Conservatives observe the same defeat in 1906 as a greater signal to change their candidate if they have traditionally performed well in the constituency.

In other words, the same defeat is perceived as a harsher lesson when the party felt more complacent beforehand, and as a result, the response is more radical. This result also reduces concerns about the baseline results being driven by long-term changes in voter preferences towards working-class interests - if this were the case one would not expect more aggressive switching of candidates in Conservative strongholds.

1.8.3 Targeting Working-Class Constituencies

Fig. 1.7 Working-Class Constituencies and Candidate Switching



This figure illustrates the main results from Table A.11: the effect of a one standard deviation increase in the 1906 loss margin on the percentage probability that the candidate is from a certain group. Both 90 and 95 percent confidence intervals are illustrated.

In the conceptual framework in Section 1.2, I argue that parties tailor the portfolio of candidates as targeted instruments to win votes. If such targeting occurs, one would expect the shock of the 1906 election to have different effects on candidate choices in 1910 depending on the type of constituency they were running in. For

example, if working-class constituencies have a preference for working-class candidates (whether as a commitment to a working-class platform in the future or because of some other personal affinity as explained by social identity theory), one would expect more aggressive switching to working-class candidates through a learning process.

I include an interaction between the Conservative's 1906 loss margin and a dummy variable indicating whether the constituency is described as a predominantly working-class constituency by Blewett (1972). The results are illustrated in Figure 1.7. While there is some evidence of switching away from political elite candidates to middle/working-class candidates in other constituencies, there is far more aggressive and significant switching in working-class constituencies. The right-hand side of Figure 1.7 illustrates evidence of switching to solely working-class candidates in response to a greater defeat in 1906.

1.9 A Winning Strategy? Implications for the 1910 Elections

The discussion of the results provide evidence of the political elite responding to the 1906 election by changing representation within the candidates in the Conservative party in 1910. One following question may be whether this strategy actually benefited them, as the previous section suggests the Conservatives may have expected by placing more working-class candidates in working-class areas. Although I do not claim a strong causal link in this analysis, the evidence is consistent with the response of targeted switching of candidates being beneficial.

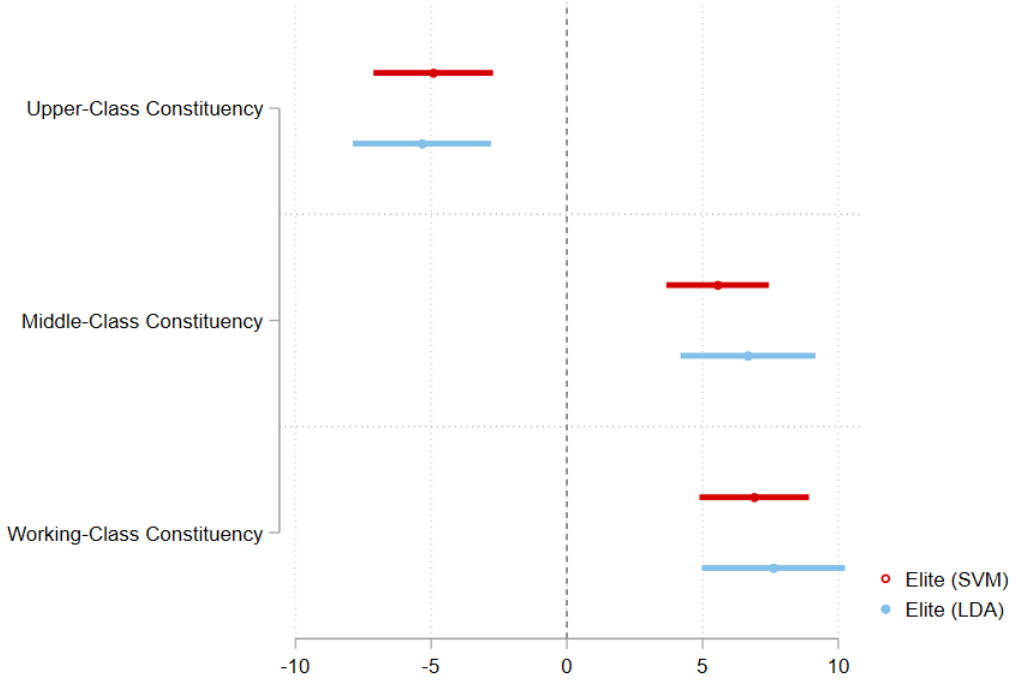
I investigate whether replacing candidates aided the Conservatives in the 1910 elections. I implement a different empirical strategy which is outlined below:

$$\begin{aligned} WinMargin_{i,1910} = \alpha + \sum_{C=U,M,W} \beta^C y_{i,1910} \times ConstituencyTypeC_i \\ + \gamma_1 y_{i,1906} + \gamma_2 WinMargin_{i,1906} + \epsilon_{i,1910} \end{aligned} \tag{1.2}$$

$WinMargin_{i,1910}$ is the proportion of the vote that the Conservatives won by in 1910 in constituency i, while $y_{i,t}$ is the characteristic of the Conservative candidate. I differentiate the effect of changing the candidate by the type of constituency, where the type of constituency C could be upper, middle, or working class (U, M, W) as defined

by Blewett (1972). As discussed in the conceptual framework, different constituencies may respond differently to different types of candidates, so I include interaction terms between the candidate characteristic and the type of constituency. I also include controls of past performance $WinMargin_{i,1906}$ and past candidate characteristics $y_{i,1906}$.

Fig. 1.8 Selecting Working-Class Candidates and the 1910 Elections



This figure illustrates the estimated impact of a one standard deviation change in the probability that the candidate is from the political elite (as estimated by the SVM/LDA) on the Conservative win margin in 1910, differentiating across constituencies.

Figure 1.8 illustrate the results, and the effect of the Conservatives moving from one candidate to another who is one standard deviation less likely to be a candidate from the political elite, for different types of constituencies. In upper-class constituencies, this replacement would cost the Conservatives around 5 percent of the vote. The contrast to middle-class and working-class constituencies is significant: the Conservatives vote share increase by around 6 and 7 percentage points by this replacement, respectively.

As suggested in the previous section, the Conservatives appear to learn and understand this pattern. There are some limitations to this analysis. For example, the Liberal and Labour election pact of 1903 had somewhat broken by 1910, which because of the plurality voting system may have aided the Conservative recovery, especially in

working-class constituencies. However, I argue that this is not a grave concern for two reasons. Firstly, the above analysis is concerned with vote shares and it seems unlikely that the Conservatives would have gained votes from Liberal voters switching to Labour candidates. Secondly, Labour and the Liberals only contested 4.5 percent of constituencies across the 1910 elections, so is a relatively small problem. A greater problem is whether an increase in Conservative vote share in 1910 is likely to arise from factors that also influence the switching of candidates. While the Conservatives kept their manifesto the same, they may have made other efforts (for example in local politics) to ingratiate themselves with a broader set of voters. As a result, the coefficient estimate of the effect of candidates on vote share may overestimate the impact of the candidates themselves. However, the results reported are consistent with the targeted switching of candidates being a successful strategy.

1.10 Concluding Remarks

There are many reasons why some groups are particularly under-represented in politics, and persistently so. I investigate the role of parties in this under-representation, and find evidence that their electoral considerations impact political representation. I find that losing an election can teach parties to cast the net wider for candidates in order to reach a wider range of voters.

These results have implications for the under-representation of other groups in politics, and in other occupations. While there are still persistent inequalities in political representation, these results suggests that parties can be motivated to widen political representation through losing elections. Further work would investigate how persistent these effects are, and how the increased inclusivity changes policy in the short and long term. Unfortunately the much-changed political landscape of British politics at the next election in 1918 make it difficult to make undertake this analysis[18]. In addition, further work would investigate under what circumstances do political parties learn to be more inclusive. Although this chapter provides an example of a party experimenting with more inclusive representation, it is important to understand under what conditions will the experiment chosen be more inclusive representation among candidates.

[18]For example, some women were given the vote in 1918 for the first time as well as all men irrespective of wealth, as well as a raft of other social and political changes throughout the First World War.

These results have wider implications beyond politics. They suggest that organisations may be inclusive in their membership in response to failure, whether it be in their hiring or selection of key decision makers. While organisations may be slow to learn, this chapter provides some evidence that organisations may eventually learn to be more inclusive, even if only through a stop-start process of learning by losing.

Chapter 2

Passing on the Baton: Positive Spillovers from the Olympics to Female Representation in US Politics

Abstract

Female representation in politics may be influenced by positive spillovers from the success of women in other professions. I exploit the timing of the Summer Olympic Games to isolate the spillover effect of female Olympic medallists on demand for female representation in US state elections a few months after the Olympics. I estimate that the female medals effect is around a 1 percent increase in female candidate vote shares in the Olympian's state of birth. This is driven entirely by the 3.8 percent increase for female Democrat candidates, exacerbating existing polarisation between parties. I do not find evidence of voters changing their attitudes about women in politics in response to female Olympic success, but find evidence consistent with female representation becoming a more important issue for Democrat voters. I estimate a 2.7 percent decrease in female representation associated with the postponement of the 2020 Olympics.

2.1 Introduction

The year 2020 marked a hundred years of women voting in presidential elections in the United States. However, female representation in US politics remains low, even by international standards. In 2018, only a quarter of elected US state politicians were women (Center for American Women and Politics, 2018) with around the same representation in the US Congress. Furthermore, women are under represented in other professions, such as in business (Matsa and Miller, 2011). One potential factor that may positively influence female representation in one profession may be spillover effects from female representation in other professions or areas of public life. However, these are generally difficult to measure.

For example, an increase in female representation in academia, law or business may have a positive spillover effect on female representation in politics. Such spillovers may influence both demand (from voters or parties) and supply (from parties or candidates) of female representation. This effect may occur through a supply-side channel, for example through the increased presence of women in professions that legislators often originate from (such as law). This may also occur through a demand-side channel, where parties and voters' perceptions of gender roles may change as a result of observing women succeeding in other arenas. Identifying these spillover effects from one arena to another is therefore non-trivial, although fundamentally important: evidence of a social multiplier effect across professions may have implications for policies encouraging more female representation. I estimate a demand-side spillover effect by exploiting the event of US women winning medals at the Summer Olympic Games (henceforth the Olympics or Olympic Games[1]).

I estimate the effect of a woman winning an Olympic medal on the vote shares of female candidates in her home state legislature, and find that the total effect is an increase of around 1 percent, and 3.8 percent for female Democrat candidates. I exploit several aspects of this setting. The first is the increase in attention to female athletes and female participation in sport during the Olympic Games, which is a relative anomaly within a sports media that is usually dominated by male athletes (Courtney et al., 2020). The second is the timing of the Summer Olympic Games, which lies between state primary and state general elections. I can therefore disentangle the decisions of

[1]I do not include Winter Olympic Games as they are often held during or even before primary elections, which does not allow for clean identification of effects on voters' decisions rather than on both political parties' and voters' decisions.

political parties and the decisions of voters, focusing on how a woman winning an Olympic medal impacts the voters' choice at the ballot box. The third is the localised media attention on a woman winning an Olympic medal in the state of her birth, which allows me to exploit variation between states in the number of medals won by women who were born in a given state. The fourth is the non-political nature of the event, which reduces concerns about potential reverse causality. Controlling for the number of women competing at the Olympic from each state (as well as district and year fixed effects), I argue that the conditional independence assumption is plausible in identifying the female medals effect. I use state electoral and Olympic data concerning over 261,842 candidate-election pairs spanning almost fifty years between 1968 and 2016, as well as 6,187 athlete-Olympic pairs which includes 1,314 medals won by women.

I also find that this positive female medals effect increases polarisation in female representation between political parties. The effect is an increase of around 3.8 percent for female Democrat candidates, yet is not significantly different to zero for their Republican counterparts in the same state. This widens the gulf in female representation between the two parties, where the proportion of state Democrat politicians who are women is almost double that of state Republicans. This has implications for other positive shocks to female representation (and to other political movements) - the same shock may be observed, yet may have heterogeneous effects on different groups.

I explore the potential causal mechanisms. I use text data from over 1,600 different newspapers and find that an increase in the number of articles mentioning female athletes in a state's newspapers is associated with an increase in the number of articles discussing female representation, or lack of, in politics. This provides evidence of a spillover from sports to politics. However, using American National Election Study data, I find no evidence of voters changing their gender role attitudes. This suggests that the increase in female candidate vote shares is not driven by voters updating their beliefs about female candidates and women in politics in response to female success in sport.

Instead, I find evidence consistent with an asymmetric issue salience mechanism: I find that more inclusive representation becomes a higher priority for Democrat voters. More medals won by women, and more articles written about their successes, is associated with an increase in the proportion of Democrat voters who believe that having greater inclusion in political decisions is a priority over other goals. This may explain some of the divergence between parties in female representation among their candidates.

The same positive shock may be observed by different groups of voters, but only respondents who are Democrat voters make more equal representation a higher priority, exacerbating the existing gap in female representation in the two main political parties. This evidence highlights a plausible mechanism, although it is not definitive.

Finally, I undertake a back-of-the-envelope estimation of the effect of postponing the Olympic Games to 2021 on the elections in 2020, using Olympic Games from 1968 to 2016. I estimate that between 1 and 4 percent (average of 2.7 percent) of female representation is associated with the female medals effect. Although this is relatively small compared to quota interventions (Besley et al., 2017; Chattopadhyay and Duflo, 2004), the impact (and therefore postponement) of the Olympic Games on female political representation is still substantial.

Contributions to the Literature: The literature that I primarily contribute to is that of female representation in politics. I contribute to the literature that explore the factors determining female representation, or lack of, in politics: why is female representation so low? Citizen-candidate models, such as those of Osborne and Slivinski (1996) and Besley and Coate (1997), suggest that if the political status quo produces a policy outcome that women broadly disagreed with, they could enter politics and gain sufficient support to contend the status quo. However, the political economy literature suggests several barriers to entry into politics for women.

One potential reason for the under-representation of women in politics may be gender bias, whether among voters or within political parties. The assessment of gender bias in the empirical literature has led to mixed conclusions. For example, the fact that female representation among candidates and female representation among elected officials are similar does not rule out gender bias - it may be that both parties and voters have similar biases against female candidates. Bhalotra et al. (2018) find evidence of gender bias influencing both the number of female legislators and candidates among socially conservative voters in India. Fulton (2012) finds that women tend to be more qualified than men before running for office. Furthermore, Kahn (1996) and Sanbonmatsu and Dolan (2009) find evidence of gender stereotyping in political campaigning and party selection of candidates, mirrored by their lack of promotion within parties (Folke and Rickne, 2016), even accounting for characteristics such as experience. However, Anastasopoulos (2016) uses close primary elections of women in US House of Representative elections and concludes that women do not receive

significantly less of the vote at the general election or less financing through campaign contributions.

This chapter adds to this literature with two main contributions. The first is exploiting the timing of US elections and a novel non-political event of the Summer Olympic Games to disentangle the effect on female representation of decisions made by voters and decisions made by political parties (focusing on the former). I therefore do not need to rely on close primary elections, as Anastasopoulos (2016) does. The second contribution is that I find evidence of polarisation in female representation, even in light of the same shock, rather than a homogeneous change across all voters and candidates.

There is also a considerable literature highlighting the impact of female political representation on policy, which motivates the further investigation of the factors that cause the under-representation of women in politics. There is solid empirical evidence that the inclusion of women in politics has a significant impact on policy. For example, evidence from India suggests that the increased inclusion of women in politics, whether through quotas (Chattopadhyay and Duflo, 2004) or through close elections (Clots-Figueras, 2011) leads to more emphasis on policy outcomes concerning early education or increased health spending. There is also evidence to support gender divides on policy preferences, such as increased social spending (Aidt and Dallal, 2008; Bertocchi, 2011) or environmental spending (Funk and Gathmann, 2015). This difference in policy preferences appears to have significant effects on outcomes, whether on child mortality in response to female suffrage (Miller, 2008) or female representation in politics (Bhalotra and Clots-Figueras, 2014), or on primary education completion (Clots-Figueras, 2012), as well as less corruption (Brollo and Troiano, 2016). Furthermore, the inclusion of more women in politics appears to have spillover effects to their male colleagues: Besley et al. (2017) find gender quotas increase the quality of male politicians while parties place more emphasis on gender equality issues (Catalano Weeks, 2019). It is clear that female representation has a significant impact on politics, so therefore it is important to understand the factors that explain why there is consistent under-representation of women in politics.

There is relatively little work, in both strands of the political science and economics literature, that investigates the effect of sporting events on political outcomes, and in particular on female representation in politics. Recent work by Depetris-Chauvin et al. (2020) suggests that sport can galvanise social ties across a nation that overcome other

differences, while Baade and Matheson (2016) discusses the costs and benefits of a country hosting the Olympic Games. Both suggest some sense of national or civic pride, but do not explore its impact on female representation. The political science literature provides support for focusing on the Olympic Games' impact on female electoral outcomes. For example, Capranica et al. (2005) and Delorme (2014) find that the Olympic Games is a rare example of female athletes enjoying as much media attention as their male counterparts. However, even cases of women garnering increased media attention may not have a significant impact on female representation or voter attitudes towards gender roles. Lake (2020) uses text data from newspapers and finds that Virginia Wade's victory at Wimbledon was portrayed as predominantly a nationalistic success rather than that for female athletes. However, to the best of my knowledge, there is no direct investigation of the effect of sporting events on female representation in politics. In particular, I contribute to the literature by using information about the electoral outcomes of 45,427 female candidate-election pairs over the course of almost 50 years and 12 Summer Olympic Games. I investigate not only how sporting events may or may not alter voter gender role attitudes or attitudes towards female representation, but I estimate the direct impact of female success in sport on female success in politics.

The remainder of the chapter proceeds as follows: Section 2.2 explains the potential spillover effect from one arena to another, Section 2.3 provides context to female representation in US politics as well as in the Summer Olympic Games, Section 2.4 presents the data, and Section 2.5 outlines the empirical identification strategy. Section 2.6 reports the baseline results, as well as heterogeneous effects between Democrat and Republican candidates, and Section 2.8 explores the potential causal mechanism for a positive female medals effect. Section 2.9 estimates a back-of-the-envelope counterfactual scenario to measure the potential effect of the 2020 Olympic Games' postponement to 2021. Section 2.10 concludes.

2.2 Spillover Effects into Female Representation

There are many ways that female representation or success in one arena may trigger success in another arena, the latter being politics in the context of this paper. I describe two potential causal mechanisms that have been discussed in the political science literature that explain a spillover effect from the success of women in one domain

to another. In the literature these domains include different sectors of work (such as academia, politics or sport) or different levels of hierarchy, within firms or sectors (such as among CEOs or lower-level managers), but not *between* sectors. There is some empirical evidence of positive spillovers within firms, whether from the hiring of female board members increasing the number of female lower-level managers (Matsa and Miller, 2011), or other top to bottom spillovers (Kunze and Miller, 2017). In this paper, I estimate the spillover effect of women succeeding in sport (by winning medals at the Olympics) on women running for office in US state legislatures, and then investigate potential causal mechanisms.

There may be supply-side effects: increased female representation among professions such as law, academia, or business, may contribute to a greater supply of potential female candidates. Furthermore, women may observe the success of women in other sectors and update their beliefs about the likelihood of female success in their own sector. These may contribute to an increase in female representation in politics. Given the identification strategy, which focuses on the spillover effect's impact on voter decisions, I discuss two potential causal mechanisms that impact the demand for female representation among voters.

One potential reason for this positive spillover is that increased female representation in one area diminishes gender stereotypes, which increases female representation in another area. In their model of social identity, Akerlof and Kranton (2000) suggest associating men in leadership roles is an example of group stereotyping which has implications for female representation across all professions. In the empirical literature, Beaman et al. (2009) find that exposure to female leaders reduces gender stereotyping in Indian village councils and increases the perceived ability of women in leadership roles. In addition, men who are on boards with women reduces 'role congruity-based gender bias' (Boutchkova et al., 2021), so those who do not conform to stereotypes are not treated unfavourably. The empirical literature primarily focuses on spillovers within sectors, but do not explore the spillover of female success in other areas on female political success through the erosion of gender stereotypes. As Kahn (1996) and Sanbonmatsu and Dolan (2009) suggest, these attitudes are often longstanding.

Another potential mechanism is one of issue salience: female representation in one area may highlight the lack of women represented in another area. This theoretical mechanism has been well-defined in the political psychology literature, which suggests that the influence of a policy on their voting decisions depends on how much they

are either affected by the policy personally or how much emphasis they place on the policy relative to others (Brent and Granberg, 1982; Krosnick, 1988; Sherif and Cantril, 1947). In the political economy literature, there has been more recent empirical evidence to support this. Ansolabehere and Socorro Puy (2018) model issue salience as the weighting voters place on different issues, and estimate that voters in the Basque Country place as much as half as much importance on nationalism as they do traditional left-right wing policy preferences. Other examples of theoretical and empirical work on issue salience show that voters often need reminding about policy issues for them to become salient, whether over taxation (Chetty et al., 2009) or spending (Huet-Vaughn, 2019).

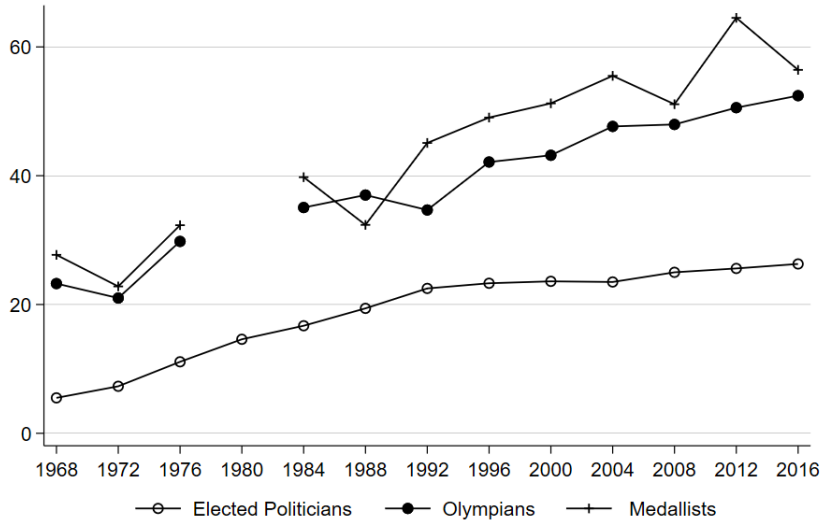
The theoretical and empirical literature largely focuses on spillover effects *within* sectors. I contribute to this literature by investigating spillover effects *between* sectors: in the case of this chapter the positive spillover between high profile female success in sport and the success of women in politics. I also find evidence suggesting that this spillover effect is unlikely to be caused by a change in voters' attitudes towards women running for office. Instead, I find some evidence consistent with issue salience: voters are newly convinced that the under-representation of women (among other groups) is a more important issue than they previously believed.

2.3 Female Representation at the Olympics and US Politics

The Nineteenth Amendment adopted in 1920 allowed women to vote for the first time in a US presidential election, with 15 states having already granted equal voting rights to women (Cascio and Shenhav, 2020). In addition, Women had been elected in state legislatures since 1894 with the election of Clara Cressingham, Carrie Holly, and Frances Klock in the Colorado House of Representatives (Center for American Women and Politics, 2018). However, female representation in US politics, both at a federal and state level, grew slowly in the first half of the twentieth century. For example, in the US Congress, only a handful of women were elected even forty years after the Nineteenth Amendment. As Figure 2.1 illustrates, the proportion of elected officials at state level who are women increases from 5.5 percent in 1968 to 22.5 percent in 1992. However, this increase slows into the twenty-first century, with just over a quarter

(26.3 percent) in 2016, and remains some distance away from equality of representation across gender in US politics.

Fig. 2.1 Representation of Women in US State Politics and Olympic Teams

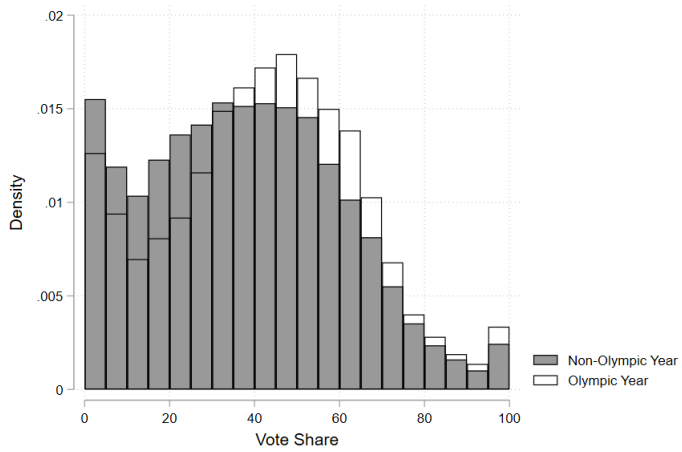


Notes: This figure shows the percentage of candidates who are elected into state legislatures who are women (solid line), as well as the percentage of US Olympians (dashed) and medallists (dotted) who are women. The figure reports these variables every four years from 1968 to 2016, including 1980 when the United States boycotted the Moscow Olympics.

Meanwhile, female representation among US Olympians and Olympic medallists has also been rising since the 1960s, with equality of representation reached in 2012 and 2000, respectively. Figure 2.1 shows that the proportion of US Olympians who were women has risen from 23.2 percent in 1968 to a majority of 52.4 percent in 2016, while the female proportion of US Olympic medallists follows a similar pattern from 27.7 percent in 1968 to 56.4 percent in 2016. This evidence is consistent with spillovers of female success across different areas, particularly with equality of representation in US Olympic teams, even though a great deal of both patterns is likely to be driven by factors such as changing attitudes to gender roles away from traditional stereotypes.

Supporting a potential spillover effect, Figure 2.2 shows how the proportion of the average vote share won by female candidates increases in Olympic years. The distribution clearly shifts to the right in Olympic years compared to non-Olympic years. Although there may be other influences, such as the coincidence of Summer Olympic Games and US presidential elections, Figure 2.2 suggests that there may be a positive influence of the Olympic Games on female electoral outcomes.

Fig. 2.2 Distribution of Female Candidate Vote Shares in Olympic and Non-Olympic Years

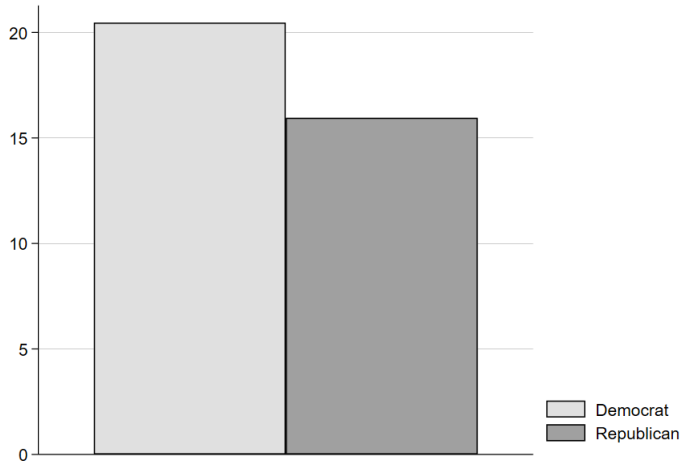


Notes: This figure illustrates the distribution of female candidate vote shares in Olympic years and non-Olympic years.

Another notable feature of female representation in US politics is the difference between the major political parties in female representation. Figure 2.3 reports the percentage of candidates in the Democrat and Republican parties in the sample who are women. Women are more represented among Democrat candidates by around 5 percentage points more than in the Republican party. A similar gap between parties exists in the proportion of winning candidates who are women, and has grown since the late 1980s and early 1990s. Given the differences between parties, I investigate potential differences in the female medals effect on female Democrat and Republicans.

This setting is ideal in testing the effects of positive shocks on female electoral outcomes for several reasons. The impact of a non-political event on political outcomes is more likely to be an exogenous shock, which I address in more detail in Section 2.5. Furthermore, the Olympic Games attracts a different type of media attention compared to most coverage of sport. Firstly, coverage tends to be more equal across genders in Olympic Games compared to most coverage of sport in the United States, which consists largely of male-dominated sports like American football, basketball and baseball. The Olympic Games provide a unique setting where female sporting achievements are appreciated in a similar manner to male achievements. Secondly, the media attention of individual athletes tends to be geographically focused. While there are many athletes who are household names across the whole of the United States, Figure 2.4 reports the

Fig. 2.3 Female Representation Across Parties, 1968-2016



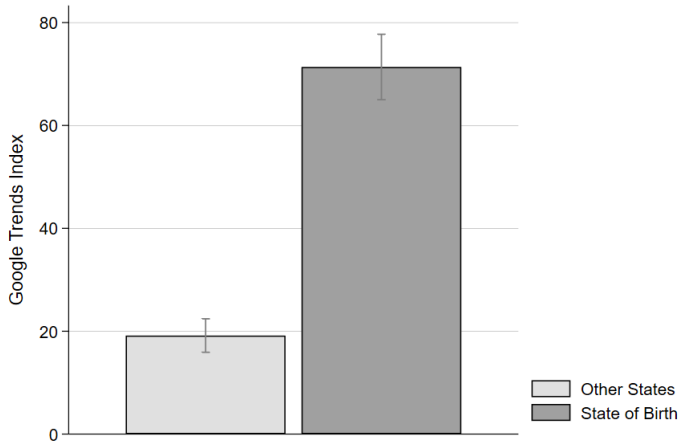
Notes: This figure compares the percentage of candidates in the Democrat and Republican parties who are women across the sample from state legislature elections held between 1968 and 2016.

difference in Google search activity for female medallists in the 2016 Summer Olympic Games. It illustrates that attention to an athlete may be localised and heightened in their state of birth, more than three times so than in other states. As a result, I am able exploit geographical variation in the number of medals won by athletes between states, as the impact of a woman winning an Olympic medal is likely to be more focused on their home state.

The political setting also presents some advantages, the most important being the timing of US state elections and the Summer Olympic Games. Almost all US state primary elections are held in the first half of the year, where the parties select their candidates for the state general elections[2]. Furthermore, the outcomes of the state primary elections are often known well before the primary elections. The Summer Olympic Games tend to be held between June and September (inclusive), and are held before the state general elections in November where voters choose between the selected candidates. This timing is ideal as it allows for a clean identification of the impact of medals won by women on the decisions of voters in the medallists' home states. This timing disentangles voter and party decisions, and focuses on the former, as the latter has already happened. In addition, the regularity of state elections (held every two

[2]There is some variation in the processes used to select candidates depending on the state and the party, but this is somewhat inconsequential for the purposes of empirical identification of the impact of female medals on voters' decisions in November.

Fig. 2.4 Localised Attention of Female Medallists, 2016 Olympics



Notes: This figure compares the Google Trends Index for female Olympic medallists at the 2016 Olympics in their state of birth and in the other states. The index is a value between 0 and 100, where 100 is assigned to the state with the most Google search activity for a particular medallist.

years in most state legislatures) allows for variation within a state of elections held in Olympic and non-Olympic years, as well as variation in the number of medals in Olympic years. Finally, the US state elections also provide a wealth of elections and candidates, with over 260,000 candidate-election pairs between 1968 and 2016.

2.4 Data

I combine two data sources. The first is state electoral data from Klarner et al. (2018), which provides information about state general elections held in all fifty U.S. states between 1967 and 2016. Importantly this excludes primary elections. There are 261,842 such candidate-election pairs, which is the unit of observation. There are also 9,787 districts in the sample: districts within a state are treated as different between different stages of redistricting, where a district may be geographically different to the "same" district a decade ago. The most pertinent information from the state electoral data for each candidate-election is the name of the candidate, the party that they are standing for in the election, and the percentage of the total votes won by the candidate in the district that they are running in. The gender of candidates is determined using the candidate's name and US census data compiled by Howard (2016). I use the candidate's first name from the electoral data and match them with the US census

data, which indicates whether the name is more likely to be associated with a man or a woman.

Table 2.1 State Election Vote Shares

Vote Share	Mean	SD	Candidates	Percent.
All Candidates	45.9	27.8	261,842	100.0
Female Candidates	45.1	27.6	45,427	17.3
Male Candidates	46.4	27.8	216,415	82.7
Female Democrat Candidates	49.1	27.0	23,535	9.0
Female Republican Candidates	45.8	25.9	15,279	5.8
Male Democrat Candidates	51.6	27.0	100,159	38.3
Male Republican Candidates	47.1	26.0	96,381	36.8

Notes: This table illustrates the mean vote shares won by candidates from several groups within the sample. The average vote share for female candidates is not a weighted average of female Democrat and Republican candidates as they also include candidates from other parties who tend to win a small proportion of votes (likewise for male candidates).

Table 2.1 illustrates the distribution of candidates across gender and political party. Female candidates receive between one to two percentage points fewer of total votes compared to their male counterparts for both parties, and make up 17.3 percent of all candidates.

The second data source concerns US Olympians. I scrape data from *Olympedia.org* to find information about US athletes who competed in any Olympics between 1968 and 2016. Profiles about each US Olympian contains their name, their sex, their date and place of birth, their college affiliations, and sporting achievements at the Olympic Games. The data includes 6,187 athlete-Olympics pairs, within which there are 4,472 athletes competing at 12 Summer Olympic Games (the United States boycotted the Moscow Olympics of 1980). The US have also won more medals at the Olympics than any other country winning 2,877 between 1968 and 2016, and 1,314 of those won by women (this includes team sports where the same medal is awarded to multiple medallists).

I combine this data with the electoral data. The mean number of female and male Olympians from a state in the sample is 4.9 and 7.4, respectively, while the mean number of medals won by women and men from the state is 3.1 and 2.6, respectively. The number of medals won by women is positively skewed (as illustrated in Figure B.3) and as Appendix B.3 shows, there is considerable variation between states and across time. One limitation is the presence of a few states (North Dakota, New Hampshire,

Idaho, and Alaska) where no medals are won by woman who were born in those states. In addition, California averages around 25 of these medals at each Olympics, more than twice the average of any other state. In the appendix I reproduce the analysis, firstly excluding the states with no variation in female medals, and secondly excluding the undisputed outlier of California. The results are robust to omitting these outliers. Another limitation are the 149 athletes where information about their state of birth is not available, while 293 athletes were born outside of the United States. I exclude both of these groups from the sample. The former is more potentially problematic, but only accounts for 3 percent of athletes.

2.5 Identification Strategy

I test whether a medal won by a female Olympian has a significant effect on female candidate vote shares in their home state. The baseline identification strategy implements a reduced-form specification:

$$FemaleVoteShare_{idt} = \alpha_d + \gamma_t + \beta_1 FemaleMedals_{st} + \beta_2 FemaleCompetitors_{st} + X'_{it}\delta + \epsilon_{idt}, \tag{2.1}$$

where the outcome variable is $FemaleVoteshare_{idt}$ is the share of the vote won by female candidate i in district d at election t, as a percentage of total votes cast in the district's election. $FemaleMedals_{st}$ is the number of medals won by women who were born in state s in the summer a few months before election t, where district d is in state s. $FemaleCompetitors_{st}$ is the number of female competitors from state s. X_{it} is a vector of controls, which include dummy variables indicating the candidate's party, whether they are an incumbent, and whether the election is held in an Olympic year, as well as the candidate's experience in the legislatures, in years. I also include district (where districts are treated as distinct between different redistricting cycle[3]) and year fixed effects, while the standard errors are clustered at the state level.

The coefficient of interest is β_1, the effect of a medal won by a woman on female vote shares in her home state. However, a naive estimate of β_1 without any fixed effects or controls is likely to have a positive bias. A state whose population is in favour of the

[3]Redistricting often radically changes the geographical boundaries of state legislature districts as a result of population changes and political gerrymandering: for example the boundaries of the fourth district of the Texas State Senate in 1968 may be significantly different to that of the fourth district in 2016.

gender equality may be more likely to have more female medallists as they encourage gender equality in participation in sport in general. In addition, that state may also have a smaller gender bias against women running for office. This would suggest a naive estimate would have a significant positive bias. To address this, I include district fixed effects (as even within states there may be significant variation in characteristics such as gender role attitudes). However, there may still exist a bias. Even with district and year fixed effects, the change in gender attitudes may differ between districts and states. For example, a state that responds more positively to the women's liberation movement in the 1970s may change its gender role attitudes more rapidly than other states. This time-variant heterogeneity (it seems unlikely that gender role attitudes in a district or state do not change between 1968 and 2016) may influence both female participation in sport and also the vote shares received by women in state elections.

Defining the connection between athlete and state by the athlete's state of birth, rather than the state of their college, somewhat reduces the bias. The time-variant heterogeneity of gender role attitudes changing at different rates may influence their participation in sport at a younger age, but less so when they go to college, which is mostly outside of their state of birth. On one extreme, if high school athletes were randomly allocated across colleges across the United States, the influence of changing gender role attitudes in their home states have less of an impact on their ability to compete at the Olympics. On the other extreme, if high school athletes only went to college in their home states, then changing gender role attitudes in their home states may have a significant impact, such as through supporting female college teams[4]. Although one suspects the reality is between the two, this still opens the possibility of time-variant heterogeneity causing some bias.

As a result, I further reduce the potential bias by including $FemaleCompetitors_{st}$, the number of female competitors (who competed at the Olympics in the summer just before the election in year t and were born in state s), to the specification. This controls for much of the time-variant heterogeneity that may influence both female electoral outcomes and the number of female medallists from the state from the above discussion. Therefore the interpretation of β_1 is the effect of a medal won by a woman

[4]Although Title IX of the Education Amendments Act (1972) requires colleges to equally support male and female athletes, there is still scope for more or less support of potential female Olympians. For example, if a state has changed its gender role attitudes more quickly, it may divert more financial assistance to colleges that is renowned for one of its female sports programs, which is more likely to impact female student athletes at the highest level (those who are potential future future Olympians).

on vote shares of female candidates in her home state, controlling for the number of women competing at the Olympics from that state (as well as district and year fixed effects). In addition, I also control for other important candidate characteristics (party, incumbent status, experience) for more precise estimation.

To summarise, the conditional independence assumption I make in the baseline specification is that changes to the vote share of female candidates is independent of women from the same state winning medals at the Olympic Games, having controlled for the number of women from the state competing at the Olympic Games. There is a ubiquity of professional and student athletes in the United States and the vast support they receive (the NCAA system provides over 180,000 sports scholarships a year[5]), from which Olympians make up a tiny group - 555 men and women at the 2016 Rio Olympic Games. It seems unlikely that factors determining whether female athletes making the step up from competing at the Olympics to winning a medal is linked to a factor that also influences female electoral outcomes in their home state (especially as many leave their home state to become professional or student athletes). Furthermore, given the widespread support hundreds of thousands of athletes receive, the level of support that Olympians and Olympic medallists receive may be very similar (especially given the likely diminishing returns to financially supporting an athlete). In other words, even if there was a significant difference in the support that a female medallist receives compared to a female Olympian, it is questionable whether this difference is linked to female electoral outcomes once I account for the number of female athletes from the state who make the step up to becoming Olympians in the first place.

2.6 Results

In this section I present the results of the baseline specification that estimates the female medals effect on female candidate vote shares in the medallists' state of birth. In addition, I undertake two falsification tests. The first is to check whether male Olympians winning medals has an effect on female candidate vote shares, and the second to check whether female medallists are associated with more female candidates (which they should not given the timing of the Olympics after the state primary elections).

[5]The number of sports scholarships is taken from the NCAA's recruiting statistics, https://www.ncaa.org/sites/default/files/Recruiting%20Fact%20Sheet%20WEB.pdf.

2.6.1 Main Results

Table 2.2 presents the estimates of the baseline specification outlined in the previous section. It shows a significant relationship between the number of medals won by women at the Olympics and the vote share of female candidates in their home state. Columns 1 and 2 present the results of the baseline specification without and with controls, which report a significant female medal effect of 0.181 and 0.151, respectively. The mean number of medals won by women from a state in an Olympic year is 3.1, so the preferred specification in Column 2 implies a total effect is an increase of 0.47 percentage points (0.151×3.1) for female candidates. This around 1 percent of the average female vote share (45.1 percent).

Columns 3 and 4 replicate the specification of Columns 1 and 2, but also include a dummy variable (Female Medals > 0) that takes a value of one if at least one woman born in the state won an Olympic medal in the summer before the election (and zero otherwise). This is to test whether the effect of the first medal won by a woman from the state dominates the overall female medal effect. This could occur if there was decreasing marginal media attention for every additional female medallist: if there is only one female medallist they may be given full attention, while the twentieth may be relegated to a footnote. However, I find that the female medal effect is not dominated by the 'extensive margin' of treatment, as the estimated impact of an additional female medal is still significant (albeit slightly lower) at the five percent significance level.

Finally, the coefficient estimates of the controls are significant (besides the Olympic year dummy), and of expected magnitude and direction. The incumbency advantage implied (around 15 percent) is similar to that of the regression discontinuity design literature measuring the incumbency advantage (Hainmueller et al., 2015; Lee, 2008), while there is a significant association between more experience in the legislature and vote shares. Finally, Table 2.2 suggests that there is a significant difference between parties in the vote shares won by female candidates, female Democrat candidates winning around 5.8 percentage points more of the vote than their Republican counterparts. This is consistent with the general divide in female representation between the two major political parties, as illustrated earlier in Figure 2.5. Finally, the female medals effect appears not to diminish in light of medals won by men. Table B.2 suggests that there is no evidence of a crowding out effect.

Table 2.2 Baseline Results: Vote Share of Female Candidates

	(1)	(2)	(3)	(4)
Female Medals (State)	0.181**	0.151**	0.173**	0.141**
	(0.0767)	(0.0715)	(0.0703)	(0.0665)
Female Medals > 0 (State)			0.178	0.242
			(0.646)	(0.544)
Female Competitors (State)	-0.0443	-0.0476	-0.0440	-0.0470
	(0.0267)	(0.0304)	(0.0266)	(0.0305)
Incumbent		15.42***		15.42***
		(1.233)		(1.232)
Experience, Years		0.551***		0.551***
		(0.0782)		(0.0784)
Democrat Candidate		5.830***		5.831***
		(1.211)		(1.211)
Olympic Year		0.0951		-0.0117
		(1.208)		(1.181)
District Fixed Effects	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y
Controls	N	Y	N	Y
Adjusted R^2	0.507	0.609	0.507	0.609
Observations	45427	45427	45427	45427

Notes: This table reports the estimates using the specification outlined in (2.1). The unit of observation is the female candidate-election. The dependent variable is the votes won by the female candidate as a percentage of total votes cast in the election in the district. Female Medals is the number of medals won in the summer before the election by women who were born in the state that the district is in, while Female Competitors is the number of female competitors who were born in the state that the district is in. Female Medals > 0 is a dummy variable that takes a value of one if at least one woman from the state won a medal in the summer before the election, and zero otherwise. Incumbent, Democrat Candidate, and Olympic Year are dummy variables that take value one if the candidate is an incumbent legislator, a candidate selected by the Democrat party, and whether the election is held in an Olympic year, respectively, and zero otherwise. Experience, Years is the number of years that the candidate has been a member of the legislature (which may also include years in another chamber within the legislature). All specifications include district and year fixed effects, while standard errors are clustered at the state level and are reported in parentheses. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

To check the validity of this result, I implement a procedure outlined by Oster (2019). I estimate δ, the coefficient of proportionality, and find that $\delta = -1.73$ for the preferred specification in Column 2[6]. This means that, in order for β_1 to be incorrectly estimated such that the true value is $\beta_1 = 0$, the selection (for treatment) on unobservables would have to be at least 1.73 times as important as selection on observables. In the context of Table 2.2, this suggests that, in order for the true value of β_1 to be equal to zero, there would have to exist some omitted variable (beyond those already specified including year and district fixed effects) that is both negatively correlated with the treatment (and positively correlated with female candidate vote shares), and is 1.73 as important in explaining the number of medals won by women in the state as the control variables and the fixed effects. Given the discussion of the conditional independence assumption in Section 2.5, it seems unlikely on both counts.

2.6.2 Falsification Tests: Male Medallists and Candidate Selection

I also test whether the effect of men winning medals has an effect on female candidate vote shares in their home state. More men winning medals may crowd out the media attention that female medallists may enjoy. Equally male success may attract more attention from the state's news media towards the Olympics in general. Media attention towards female Olympians may increase as male success increases total attention to local sporting heroes at the Olympics (rather than just national household names) - so the success of a female athlete from the state may have greater coverage as a result of their male counterparts. To identify whether the net effect is significant, I undertake this falsification test by using the baseline specification and replacing the number of female medallists and female competitors from the state with the number of male medallists and male competitors from the state.

Table 2.3 provides the main results from this altered specification. In all four specifications the number of medals won by men from the state has no significant effect on the vote share won by female candidates in the state. The effects are negative, but they are both statistically insignificant and an order of magnitude smaller than the estimates effects of female medallists in Table 2.2. Furthermore, the binary variable of whether any men from the state win medals or not appears to have an significant effect.

[6] As recommended by Oster (2019), I estimate δ using $R_{max} = 1.3 \times \tilde{R}$, where $\tilde{R}$ is the estimated R-squared from the specification in Column 2.

Table 2.3 Falsification Test: Male Medallists and Female Candidate Vote Shares

	(1)	(2)	(3)	(4)
Male Medals (State)	-0.0328	-0.0315	-0.0386	-0.0408
	(0.0394)	(0.0405)	(0.0389)	(0.0397)
Male Competitors (State)	0.0592	0.0461	0.0523	0.0380
	(0.0388)	(0.0355)	(0.0411)	(0.0383)
Male Medals > 0 (State)			0.532	0.779
			(0.561)	(0.618)
District Fixed Effects	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y
Controls	N	Y	N	Y
Adjusted R^2	0.507	0.609	0.507	0.609
Observations	45427	45427	45427	45427

Notes: This table reports the estimates using the specification outlined in (2.1). The unit of observation is the female candidate-election. The dependent variable is the votes won by the female candidate as a percentage of total votes cast in the election in the district. Male Medals is the number of medals won in the summer before the election by men who were born in the state that the district is in, while Male Competitors is the number of male competitors who were born in the state that the district is in. Male Medals > 0 is a dummy variable that takes a value of one if at least one woman from the state won a medal in the summer before the election, and zero otherwise. Columns 2 and 4 include controls, which are incumbent, Democrat candidate, Olympic year dummy variables, and the candidate's experience in the legislature, in years. All specifications include district and year fixed effects, while standard errors are clustered at the state level and are reported in parentheses. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

This evidence is supported by Table B.2, which interacts the number of medals won by women from the state with the number of medals won by men from the state. There also appears to be no effect of the number of medals won by men on the effect that medals won by women has on female candidate votes shares in their home state.

Another falsification test is to estimate the effect of medals won by women on female candidacy. According to the Olympic-election timeline, there should not be an effect of female medallists on female candidacy, as candidates are selected before the Summer Olympic Games. However, there may be an anticipation effect: part of the effect of female medallists on female candidate vote shares that occurs when female athletes win medals may also occur before the Olympic Games, as some may identify certain athletes as favourites to win a medal.

Table 2.4 Falsification Test: Female Candidacy and Female Medallists

	(1)	(2)	(3)	(4)
Female Medals (State)	0.0414	0.0491	0.0578	0.0612
	(0.0440)	(0.0438)	(0.0491)	(0.0481)
Female Medals > 0 (State)			-0.420	-0.334
			(0.256)	(0.259)
Female Competitors (State)	-0.0181	-0.0216	-0.0182	-0.0221
	(0.0284)	(0.0278)	(0.0274)	(0.0273)
District Fixed Effects	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y
Controls	N	Y	N	Y
Adjusted R^2	0.151	0.158	0.151	0.158
Observations	261842	261842	261842	261842

Notes: This table reports the estimates using the specification outlined in (2.1), but replaces the dependent variable with a dummy variable which takes a value of one if the candidate is female, and zero otherwise. The unit of observation is the candidate-election, and notably includes female and male candidates. Female Medals is the number of medals won in the summer before the election by women who were born in the state that the district is in, while Female Competitors is the number of female competitors who were born in the state that the district is in. Female Medals > 0 is a dummy variable that takes a value of one if at least one woman from the state won a medal in the summer before the election, and zero otherwise. Columns 2 and 4 include controls, which are incumbent, Democrat candidate, Olympic year dummy variables, and the candidate's experience in the legislature, in years. All specifications include district and year fixed effects, while standard errors are clustered at the state level and are reported in parentheses. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

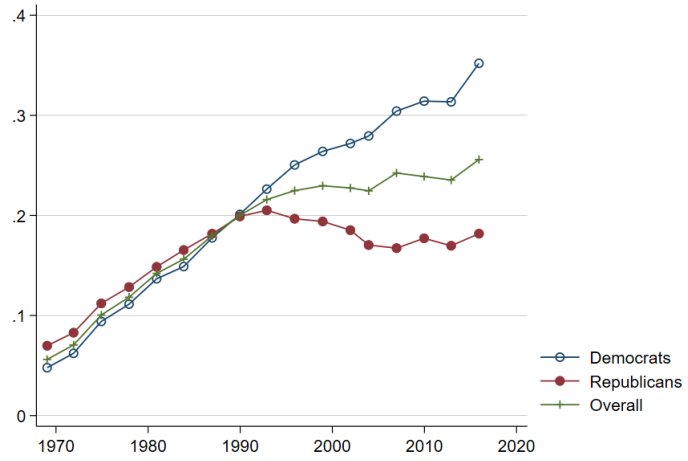
I replicate the baseline specification, but replace the outcome variable with a dummy variable: is the candidate a woman (value of one) or not (zero)? As a result, I also include all candidates in the sample, both female and male, as opposed to the baseline specification which only includes female candidates. Table 2.4 reports the results of this adapted specification, and confirms that there is no significant impact of medals won by women on female candidacy in their home state. This finding is robust across the same specifications.

2.7 Party Polarisation

As discussed in Section 2.4, there are significant differences between the Democrat and Republican parties in female representation, whether as elected officials or as candidates. The political science literature highlights long-running differences in female

representation between parties (Adams, 1997; Carmines and Woods, 2002; Carroll and Sanbonmatsu, 2013), potentially linked to their policy platforms. Further, there has been a divergence in female representation since the late 1980s and early 1990s, as illustrated in Figure 2.5.

Fig. 2.5 Party Differences in Female Representation



Notes: This figure reports the changes in female representation among state legislature candidates (female candidates as a percentage of all candidates) across time, as well as the differences between the major political parties.

Figure 2.5 shows that the proportion of Democrat candidates who are women has continued to increase since the beginning of the sample in the late 1960s. This is only true among Republican candidates until the early 1990s, at which point there is even a small decrease in female representation among Republican candidates. While I do not claim to explain this polarisation, I investigate whether heterogeneity between parties in their female medal effects are consistent with this divergence. I do this by testing whether the female medal effects is significantly larger for either female Democrat candidates or female Republican candidates.

I supplement the baseline specification with an interaction term between medals won by women from the state and a dummy variable that takes value of one if the candidate has been selected by the Democrat party. The results of the adapted specification, including a Democrat candidate dummy variable interaction with female medals, are reported in Table 2.5. Most notably, the positive female medal effect is driven almost entirely by an increase in the vote share of female Democrat candidates. The first row effectively presents coefficient estimates of the effect of female medals on female

Table 2.5 Party Polarisation: Democrat and Republican Candidates

	(1)	(2)	(3)	(4)
Female Medals (State)	-0.110	-0.0990*	-0.0511	-0.0511
	(0.0799)	(0.0546)	(0.0453)	(0.0453)
Democrat Candidate	5.638***	5.214***	4.954***	4.954***
	(1.877)	(1.068)	(1.030)	(1.030)
Female Medals (State) × Democrat Candidate	0.672***	0.559***	0.455***	0.455***
	(0.209)	(0.156)	(0.160)	(0.160)
Female Medals > 0 (State)			-0.753	-0.753
			(0.964)	(0.964)
Female Medals > 0 (State) × Democrat Candidate			1.518	1.518
			(1.079)	(1.079)
District Fixed Effects	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y
Controls	N	Y	N	Y
Adjusted R^2	0.518	0.611	0.611	0.611
Observations	45427	45427	45427	45427

Notes: This table reports the estimates using the specification outlined in (2.1), and includes interactions between . The unit of observation is the female candidate-election. The dependent variable is the votes won by the female candidate as a percentage of total votes cast in the election in the district. Female Medals is the number of medals won in the summer before the election by women who were born in the state that the district is in. Democrat Candidate is a dummy variable that takes value of one if the candidate is selected by the Democrat party for the general election. Female Medals > 0 is a dummy variable that takes a value of one if at least one woman from the state won a medal in the summer before the election, and zero otherwise. Columns 2 and 4 include controls, which are incumbent and Olympic year dummy variables, and the candidate's experience in the legislature, in years. All specifications include the number of female competitors from the state, as well as district and year fixed effects, while standard errors are clustered at the state level and are reported in parentheses. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

Republican candidate (as well as independent candidates). The estimates are much smaller than the baseline estimates in Table 2.2 and insignificant (with the exception of Column 2). In contrast, the effect for female Democrat candidates is between 0.4 and 0.7 percentage points for each medal won by a woman. Taking the estimate from the preferred specification in Column 2, the total effect of the average treatment of 3.1 medals won by women from the state is around 1.7 percentage points, or equivalently an increase of 3.8 percent from the average female candidate vote share. This suggests that there is divergence between candidates of different parties in response to the same shock in a given state. Furthermore, this divergence is exacerbating an already wide gap between parties in female candidate vote shares of around 5 percentage points, as reported in the second row of Table 2.5. These results are robust to including a binary variable of whether any medals were won by women from the state at all in Columns 3 and 4. Columns 3 and 4 also suggest the importance of the first medal, although the estimates are noisier despite the point estimate being far larger than the effect for each medal.

Although Table 2.5 provides evidence of a positive shock creating more divergence in female representation between the Republican and Democrat parties, there are potential issues with interpreting the causal mechanism. This effect may well occur due to voters switching parties (for example from a male Republican candidate to a female Democrat candidate). However, this effect may also be a result of would-be Democrat voters choosing to vote instead of staying at home on election day. In the absence of information regarding these choices at a state legislature level, one cannot conclude definitively what the causal mechanism may be that links female success in sport and female success in politics.

2.8 Causal Mechanism

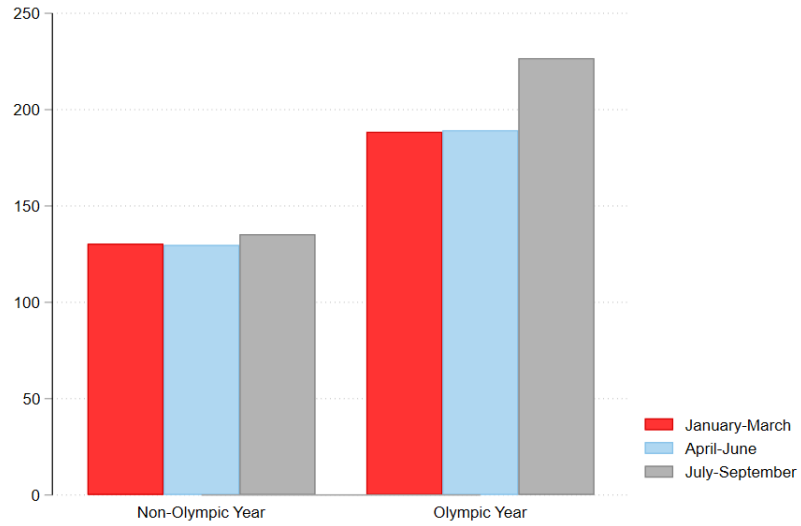
In this section, I explore the causal mechanism behind the female medals effect that I observe in the previous sections, as well as its heterogeneity between candidates of different parties. To further provide evidence of a spillover effect, I test whether there is also spillover effect from female success at the Olympics and women in politics through newspaper reporting. I then test how this spillover effect affects voters, and whether it likely to be either one of two potential causal mechanisms, which I discuss in Section 2.2. The first mechanism that I test is whether voters observe female success

at the Olympics, and as a result update their beliefs about women in politics, or their attitudes towards gender roles. The second mechanism is one of issue salience. Voters may be reminded of the lack of women in politics by the news media (in light of reporting on female Olympic success), and as a result prioritise female representation in politics more highly at the upcoming election. This would be the case even if voters do not change their beliefs about women in politics.

2.8.1 From the Back Pages to the Front Pages

I investigate the causal mechanism that links female success in sport to politics. I first do this by identifying the link between discussion of female Olympians and discussions of female representation. I scrape data from *newspapers.com*, which includes 1,608 different newspapers across the United States between 1968 and 2016, for all state-year pairs where a state election was held. The minimum number of newspapers for a state is 3 in Rhode Island, while the maximum is California with 115.

Fig. 2.6 Discussion of Women in Politics and Women at the Olympics



Notes: This figure illustrates the average number of articles written in a state' newspapers in each three month period that include key phrases 'women in politics', 'female representation', and 'under-representation of women' (or similar variations), in non-Olympic and Olympic years.

Figure 2.6 presents the average number of articles that a state's newspapers mention key phrases 'women in politics', 'female representation in politics', 'under-representation of women in politics', and similar variations, across the three quarters leading up to

the elections in a non-Olympic and Olympic year. There are two notable features of Figure 2.6. The first is the level increase in the discussion of female representation in Olympic years compared to non-Olympic years. The second is the increase in discussion of female representation from the first two quarters of the year to the third, which is significantly larger in Olympic years than in non-Olympic years. These two features may be somewhat explained by the coincidence of Olympic years and US presidential elections: this may generally increase discussion about politics in newspapers (and potential about female representation in politics), as well as a further increase as the election looms closer. However, the large increase in discussion of female representation in politics that occurs after July also coincides with the Summer Olympic Games. Despite this, Figure 2.6 provides some motivation of a link between reporting on women in sport and politics.

To identify the effect of female Olympians on the discussion of female representation in politics, I use the following specification:

$$PoliticsMentionsJS_{st} = \alpha_s + \gamma_t + \beta_1 OlympianMentionsJS_{st} + \beta_2 PoliticsMentionsAJ_{st} + \epsilon_{st} \tag{2.2}$$

The unit of observation is the state-year. The outcome variable, $PoliticsMentionsJS_{st}$, is the natural logarithm of the number of articles in a state's newspapers mentioning female representation (or other related phrases) in the third quarter of the year (July to September). The treatment variable, $OlympianMentionsJS_{st}$, is the natural logarithm of the number of articles in the state's newspapers mentioning a female Olympian who was born in the state. I also include $PoliticsMentionsAJ_{st}$, the logarithm of the number of articles in a state's newspapers mentioning female representation in the second quarter of the year (April to June). Finally, I include state and year fixed effects, while the standard errors are clustered at the state level.

The estimates of this specification are reported in Table 2.6. Columns 1 and 2 include all state-election pairs. However, it may not be reasonable to assume that the counterfactual of a state in an Olympic year having fewer mentions of its female Olympians is similar as the same state in a non-Olympic year. Therefore the specifications estimated in Columns 3 and 4 only include elections held in Summer Olympic years. The first row presents the estimated effect of the number of articles mentioning female Olympians on the discussion of female representation in politics. The effect of female Olympian mentions on the discussion of female representation is significant across all specifications.

Table 2.6 Newspapers: Discussion of Female Olympians and Women in Politics

	(1)	(2)	(3)	(4)
Female Olympian Mentions (July-September)	0.0653***	0.0753***	0.104***	0.106***
	(0.0178)	(0.0265)	(0.0356)	(0.0351)
Male Olympian Mentions (July-September)		-0.0159		0.0507
		(0.0224)		(0.0371)
Women in Politics Mentions (April-June)	0.285***	0.285***	0.205**	0.201**
	(0.0847)	(0.0846)	(0.0807)	(0.0783)
State Fixed Effects	Y	Y	Y	Y
Year Fixed Effect	Y	Y	Y	Y
Olympic Years Only	N	N	Y	Y
Adjusted R^2	0.837	0.837	0.803	0.804
Observations	1754	1754	763	763

Notes: The unit of observation is the state-election. The dependent variable is the natural logarithm of the number of articles in a state's newspapers mentioning female representation (or other related phrases). Female and Male Olympian Mentions (July-September) is the natural logarithm of the number of articles in the state's newspapers mentioning a female and male Olympian who was born in the state, respectively. Women in Politics Mentions (April-June) is the logarithm of the number of articles in a state's newspapers mentioning female representation between April and June of the election year. Columns 1 and 2 include all state-elections in the sample, whereas 3 and 4 only include elections in Olympic years. All specifications include state and year fixed effects, while standard errors are clustered at the state level and are reported in parentheses. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

Doubling the number of articles mentioning female Olympians increases the number of articles mentioning female representation by 6.5 to 10.6 percent. For the average state in an Olympic year, this increases the number of articles written about female representation from 75 a month to between 80 and 83. Given that there are on average 32 newspapers for each state in the newspaper data, this means a reader of one newspaper may read an article about female representation from once every 12.8 days to once every 11.5 days. While the effect I find is not particularly large, it provides evidence of a link between the reporting of women in sport and female representation. In Columns 2 and 4 I also include the number of mentions of male Olympians as a falsification test. As expected, the reported estimates in the second row of Table 2.6 do not suggest they have a significant effect on discussions of female representation.

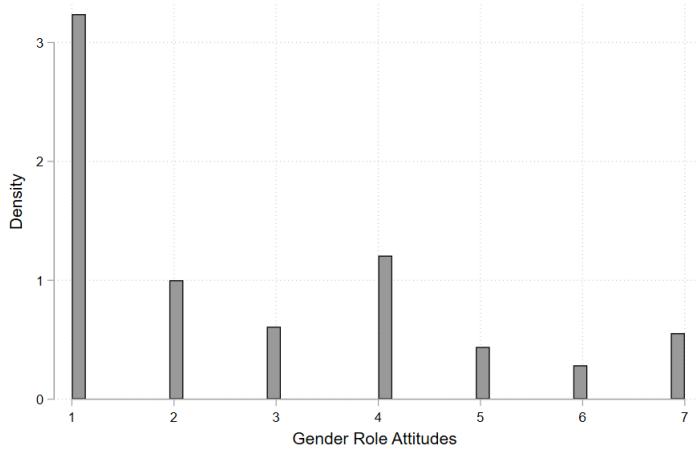
This suggests that newspapers write more about female representation in politics when they write more about female Olympians. This link may be an editorial one or from individual journalists, linking the then topical theme of female success in sport

(which is largely concentrated to the Olympics) to female representation, or lack of, in politics. Overall, the newspaper data supports the causal mechanism of a spillover from discussions in sport to politics through discussions in the media.

2.8.2 Voter Gender Role Attitudes

To further investigate the causal mechanism, I test the effect of the positive shock on attitudes towards gender. I use survey data from the American National Election Study to test whether observing female medallists alters attitudes towards gender roles among voters. The American National Election Study collected 27,045 responses to the following question across 16 election years between 1972 and 2008 (some in presidential election years and some in other election years): '*Recently there has been a lot of talk about women's rights. Some people feel that women should have an equal role with men in running business, industry, and government (1). Others feel that a woman's place is in the home (7). And of course, some people have opinions somewhere in between, at 2,3,4,5, and 6. Where would you place yourself on this scale or haven't you thought much about this?*' Figure 2.7 illustrates the distribution of answers across time. While around 44 percent of respondents indicated a preference of total equality, an additional 22 percent were in favour but less strongly. Furthermore a large minority of over 17 percent indicated some preference against equality of gender roles.

Fig. 2.7 Gender Role Attitudes



Notes: This figure reports the distribution of answers (from all years) to the American National Election Study question about women's roles in public life. For example, an answer of one represents those who 'feel that women should have an equal role with men in running business, industry, and government', while an answer of seven represents those who 'feel that a woman's place is in the home'.

To test whether there is any meaningful changes to votes I estimate the effect of medals won by women in the state on the gender role attitudes of voters from that state. These estimates are reported in Table 2.7. Columns 1 and 2 estimate the effect of women winning medals on gender attitudes. Including state and year fixed effects, the estimated effect of all sporting success (male or female) appears to be insignificant. Furthermore, these estimates are orders of magnitude smaller than what one would expect to be an observable change in gender attitudes. This is confirmed in Columns 3 and 4 where I use the number of articles mentioning female Olympians at the time and immediate aftermath of the Olympics (controlling for the number of articles mentioning them earlier on in the year). In addition, the gender of the respondent appears to be far less significant than differences between states and years.

Table 2.7 Gender Role Attitudes and Female Medallists

	(1)	(2)	(3)	(4)
Female Medals (State)	0.000576	0.000419		
	(0.00287)	(0.00261)		
Female Competitors (State)	0.000886	0.000787		
	(0.00111)	(0.00103)		
Female Olympian Mentions (July-September)			0.00131	0.00412
			(0.0227)	(0.0230)
Female Olympian Mentions (April-June)			0.00421	0.000426
			(0.0239)	(0.0239)
State Fixed Effects	Y	Y	Y	Y
Year Fixed Effect	Y	Y	Y	Y
Controls	N	Y	N	Y
Adjusted R^2	0.0787	0.0791	0.0787	0.0791
Observations	25454	25297	25454	25297

Notes: This table reports the estimates of the effect of female medals and related reporting on gender role attitudes. The dependent variable is the answer that the respondent, which is between 1 (equal role) and 7 (women's place is in the home). Female Medals is the number of medals won in the summer before the election by women who were born in the state that the district is in, while Female Competitors is the number of female competitors. Female Olympian Mentions (July-September) and Female Olympian Mentions (April-June) are the natural logarithm of the number of articles in the state's newspapers mentioning a female Olympian who was born in the state between July-September and April-June, respectively. Columns 2 and 4 include controls which include categorical variables concerning the respondent's ethinicity and gender. All specifications include state and year fixed effects, while standard errors are clustered at the state level and are reported in parentheses. Columns 1 and 3 have more observations than Column 2 and 4 due to a smaller number of missing respondents with missing control variable data, such as ethnicity or party affiliation. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

There appears to be no change in attitudes towards gender in response to women winning medals at the Olympics. This discounts the explanation that female success in sport translates to female success in politics as voters update their beliefs away from traditional gender stereotypes. To some extent this is somewhat expected: attitudes such as these are often formed from voters' family backgrounds and other long-term factors. The survey evidence suggests that these attitudes do not change in a significant manner in the time between the summer Olympics and elections in November. Furthermore, a voter observing a woman from their state win an Olympic medal against other women may not change their belief of a female candidate's ability against a male one. Table 2.6 provides evidence that the causal mechanism is unlikely to involve voters updating their gender role attitudes or gender biases. This is supported by evidence presented in Table B.1 that reports no persistent female medals effect on female candidate vote shares in elections two years after an Olympic Games: one would expect changes to gender role attitudes to be relatively long-lasting.

2.8.3 Issue Salience

The causal mechanism between medals being won by women and female electoral success appears not to be driven by changing gender biases. The increase in discussion about female representation that occurs from women winning medals at the Olympics attracts may attention to the lack of women in politics. As discussed in Section 2.2, one may also assume that voters have a limited selection of issues that they are particularly concerned about when they go to the ballot box, for example the level of income tax. In the context of this paper, voters may be newly convinced that the under-representation of women in politics is a more important issue than they previously believed. This may lead to an increase in votes for female candidates.

I test this using the American National Election Survey data. Another question that the Survey asks relates to how highly do voters prioritise equality in influence over policy. The question asked (every four years from 1972 to 1992) '*For a nation, it is not always possible to obtain everything one might wish. On this page, several different goals are listed. If you had to choose among them, which one would seem most desirable to you?*

1. *Maintaining order in the nation.*

2. *Giving more people more say in important political decisions.*

3. Fighting rising prices

4. Protecting freedom of speech'

While the second option is not a perfect measure of issue salience of female representation, it does illustrate whether voters *prioritise* equality in political decisions (over other policy issues), of which gender equality is a key component. I test whether observing women winning medals, or newspapers discussing their success, impacts whether voters prioritise equality in political decisions. The outcome I use is the binary variable that indicates whether the respondent selects the second issue as their main priority[7] and implement previous specifications. To test whether there is an asymmetric issue salience effect, I include a dummy variable indicating whether the respondent identifies with the Democrat party and an interaction effect between that dummy variable and the number of medals won by women who were born in the respondent's state.

Table 2.8 presents the results. Columns 1 and 2 report the effect of medals won by female Olympians on whether voters from their home state prioritise equality of representation above other issues, with and without controls, respectively. There appears to be a positive female medals effect of around 0.32 percentage points. Given that the average number of medals won by women for a given state in the sample is 3.1, the total effect is around 0.99 percentage points (0.32×3.1), or an increase of 3.9 percent from the average probability of a respondent prioritising equality of representation of 25.5 percent. However, the estimates in Columns 1 and 2 are relatively noisy. Columns 3 and 4 split interact the number of medals won by women from the respondent's state with whether the respondent is a Democrat voter. I include this interaction as Table 2.5 shows that Democrat voters respond differently to the female medals effect compared to Republican voters, and this occur through differences in an issue salience mechanism. Columns 3 and 4 report a significant difference between Democrat and Republican voters. The first row effectively reports the estimated effect on Republican voters, which is positive but insignificant. However, the second row shows that Democrats are more influenced by a female medals effect when it comes to prioritising equality of representation.

While the results in Table 2.8 is only evidence consistent with an issue salience mechanism and not direct evidence, it is also consistent with the asymmetric female medals

[7]I assign value 100 to illustrate percentage point effects in the coefficient estimates.

Table 2.8 Female Medallists and Issue Salience (Equality of Representation)

	(1)	(2)	(3)	(4)
Female Medals	0.319*	0.322*	0.235	0.231
	(0.163)	(0.165)	(0.176)	(0.177)
Female Medals × Democrat Voter			0.199***	0.211***
			(0.0387)	(0.0370)
State Fixed Effects	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y
Controls	N	Y	N	Y
Adjusted R^2	0.0299	0.0328	0.0315	0.0340
Observations	9136	9102	9136	9102

Notes: This table reports the estimates of the effect of female medals on the likelihood of a respondent prioritising equality of representation above the other suggested national priorities. The dependent variable is a dummy variable that takes value 100 if the respondent chooses option 2 in answer to the question outlined above (so that the coefficients can be interpreted as the effect on the percentage probability of choosing option 2), and zero otherwise. Female Medals is the number of medals won in the summer before the election by women who were born in the state that the district is in, while Democrat Voter is a dummy variable that takes value one if the respondent feels affiliated to the Democrat party. Columns 2 and 4 include controls, which consist of the categorical variables concerning the respondent's ethnicity and gender. All specifications include also Female Competitors and Democrat Voter, as well as state and year fixed effects. Standard errors are clustered at the state level and are reported in parentheses. Columns 1 and 3 have more observations than Column 2 and 4 due to a smaller number of missing respondents with missing control variable data, such as ethnicity or party affiliation. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

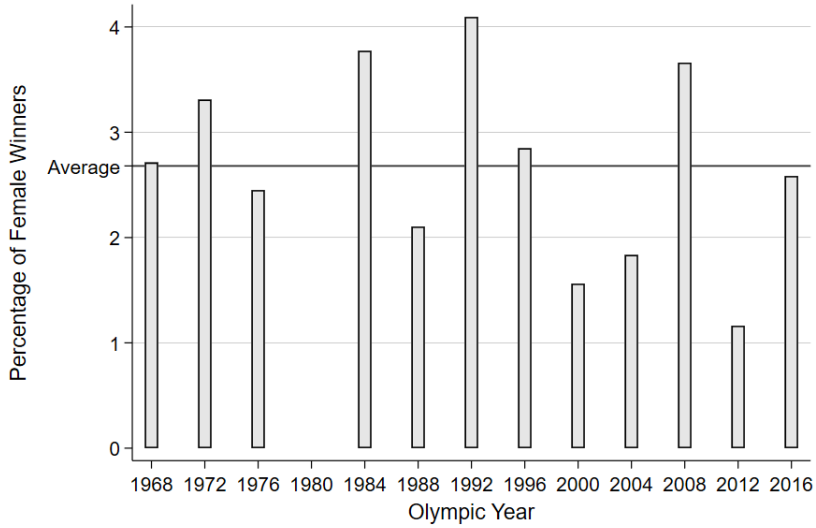
effect that is observed in Table 2.5. Further research would explore this asymmetric issue salience effect with more direct evidence, as well as explaining why there exists such a divergence between political parties. A similar argument may be that Democrat voters read more of the discussions about women in politics. In addition to this evidence, Table B.1 suggests that this issue salience mechanism may be fleeting and that voters need to be reminded again - the effect is non-existent on the next elections two years later.

2.9 Counterfactual Simulation

I estimate a back-of-the-envelope counterfactual scenario describing the case where the Olympic Games are not held, and therefore the positive shock to female representation is not realised. The results of this scenario may be relevant in evaluating the US boycott of the 1980 Moscow Olympics and the postponement of the 2020 Tokyo

Olympics to 2021. Given the noticeable difference between the two parties in the female medal effects, I assume heterogeneous female medal effects between the Democrat and Republican parties (using the estimates of the preferred specification in Column 2 of Table 2.5).

Fig. 2.8 Counterfactual Simulation, Female Medal Effect (Percentage of Female Winners)



Notes: This figure illustrates the results of the counterfactual scenario that removes the female medal effect. It reports the percentage of successful female candidates that hypothetically would have lost removing the estimated female medal effect from their vote share.

I estimate the lost vote share for women in the absence of an Olympic games and therefore no women winning medals from the state. This loss will therefore be homogeneous among female candidates within the state. I calculate this using the number of medals won by female Olympians from a given state and a given Olympic year, and the estimated effect as reported in Column 2 of Table 2.5. I calculate the proportion of successful female candidates who hypothetically would have lost their election without the estimated female medal effect. Figure 2.8 illustrates these estimates across different Olympic years (the United States boycotted the Moscow Olympics of 1980). The estimated proportion of female candidates that are associated with the female medal effect is between 1 and 4 percent between 1968 and 2016, with an average of 2.68 percent. Although these estimations are not particularly sophisticated, these counterfactual scenarios suggest that the postponement of the Tokyo Olympics to 2021

(and therefore not in the election year of 2020) may have a non-negligible effect on female representation in US politics.

2.10 Concluding Remarks

I find that a non-political event, a woman winning a medal at the Summer Olympic Games, has significant spillover effects on female electoral outcomes. I estimate that the total effect of medals won by women is around an increase of 1 percent of the average female candidate vote share in the Olympians' state of birth. I also find that this event has a polarising effect: this effect is around 3.8 percent for female Democrat candidates, whereas it is not significantly different to zero for female Republican candidates. This difference exacerbates an already wide gap in female candidate vote shares between the Democrat and Republican parties. More generally, these results illustrate the impact of high-profile events on voting outcomes.

Data from newspapers suggests that there is a spillover from the increased discussion of female Olympians in light of their Olympic success to the discussion of female representation (or the lack of) in politics. Medals won by women appear to not have an effect on gender role attitudes for voters, which suggests that they do not increase female candidate vote shares by changing updating voters' beliefs concerning gender in comparing female politicians to male politicians. I find evidence consistent with an issue salience mechanism. Women winning medals increases the probability that voters prioritise more inclusivity in political decisions, but only so for those who identify as Democrat voters. These results suggest that events that may be described as positive shock may also lead to increased polarisation, even within the same state. A woman winning an Olympic medal is associated with a divergence in vote shares between female Democrat and Republican candidates in her home state.

These results may have three main implications for more equal representation (whether on gender, racial, or other dimensions) in politics and beyond. The first is that positive spillovers in more equal representation may exist, even between areas that are seemingly unrelated. The second is that these positive spillovers may actually lead to increased polarisation within groups, such as between Republican and Democrats within the same state. An event that all voters observe, for example the police killing of George Floyd, may at the same time be positive for the Black Lives Matter movement and BAME representation in politics yet also increase polarisation, in attitudes and outcomes,

as the same shock observed has heterogeneous effects on voters. Further work would investigate other spillovers, as well as more cleanly identify the reasons for polarisation in the face of observing a common shock. The final implication is that the impact of celebrating the success of under-represented groups in one field is not only to encourage more participation of those under-represented, but also to highlight issues of their under-representation in other fields, such as in politics.

Chapter 3

Temporal and Geographical Spillovers in Female Political Representation

Abstract

The election of a significant female politician is often followed by discussions of a potential trailblazing effect for women in other elections. I estimate both temporal and geographical spillover effects of a woman being elected to office on future female representation. I use an instrument that exploits the close election of women as a quasi-random treatment, and the results of state legislature elections covering over 143,000 district-election pairs from all fifty US states from 1968 to 2016. I find a significant and persistent temporal spillover: the election of a woman increases female representation among candidates and elected politicians in the district in future elections. The short-term effect is driven by incumbency advantage of elected women, but I also identify a longer-term increase in the proportion of new candidates who are women. Similarly, the geographical spillover effect across a given state increases female representation, but the shift from incumbents to new candidates is less marked.

3.1 Introduction

As motivated in the previous chapter, women have persistently been under-represented in many high-profile professions, and in particular in politics. While the previous chapter focused on spillover effects from one profession to another, this final chapter focuses on spillovers within politics. Significant elections and candidacies of female politicians often lead to discussions about their influence on future female representation. For example, what may be the effect of the recent elections of Kamala Harris as vice-president and prominent Congresswomen such as Alexandria Ocasio-Cortez on future female representation in US politics?

In this chapter I estimate the spillover effect of a woman being elected to office on future female representation in politics. The election of a woman may influence future female representation through two channels. One may be a **temporal spillover**: for example, female representation among candidates or elected officials in a given district and a given election may be influenced by the election of a woman in the same district in a previous election. Another may be a **geographical spillover**, where the election of a woman in one district may influence female representation in future elections in other districts, such as other districts in the same state legislature.

I estimate the effect of a woman winning an election through these two channels on future female representation among both all candidates and successful candidates (winners). To do this in a plausibly causal manner, I exploit the close election or non-election of women, as only correlating the election of women in a given election with future female representation may suffer from a positive bias from unobserved heterogeneity, such as voters' attitudes to gender stereotypes.

Within a small margin (whether a winner or losing margin), I assume that whether a candidate is elected or not is quasi-random. In doing so, I am able to calculate the 'expected number' of women elected to office by a small margin[1], following the example of (Hyytinen et al., 2018). I exploit variation between the observed number of women winning by a small margin and this 'expected number'. Using this difference as an instrument captures variation in the number of women elected to office in a given district-election pair that arises from the random outcomes for candidates within these

[1]This 'expected number' for a given district-election pair is calculated using the number of women winning or losing by a small margin, and the winning proportion of all candidates who win or lose by small margin.

small margins. I use US state legislature election returns from Klarner et al. (2018), which constitutes over 143,000 district-election pairs in the 99 state chambers across the 50 states[2] I am able to compare both the short-term and long-term effect as the data covers almost 50 years from 1968 to 2016.

I find a considerable short-term impact within a given district: the election of a woman increases female representation among candidates in the district at the next election by 24.0 percentage points and the likelihood that an elected winner is a woman by 44.4 percentage points. This short-term effect is driven by female incumbents running for re-election, which is expected given a well-documented incumbency advantage in US politics. Further, the positive spillover is not restricted to the short run. In the long run there is a similarly positive and significant effect that is driven by an increase the female proportion of candidates and winners who are not incumbents running for re-election. These results suggest a substantial 'multiplier effect' in political representation as new female candidates replace female incumbents.

I also find positive and significant geographical spillovers. I measure these geographical spillovers by exploiting variation in the close election of women across the state chamber (for example, the New York State House of Representatives), and estimating the impact of these election of women on female representation in future elections within the state chamber. There is a positive, significant, and persistent temporal spillover effect that only somewhat fades four elections after the 'treatment' election. For example, the election of a woman in a district increases the probability that a candidate is a woman in subsequent elections by around 2.4 to 3.7 percent. The estimated spillover effect on new female candidates across the state is consistent with the overall effect being initially driven by incumbents, and then by new female candidates, although not as clearly supported as the evidence at the district level.

These results are relevant to economists as there is evidence that female representation, and therefore under-representation, may have a significant effect on policy choices. Citizen-candidate models such as those of Osborne and Slivinski (1996) and Besley and Coate (1997) suggest that, conditional on the existence of differences in policy preferences between genders, an increase in female political participation and representation should alter collective policy choices. In terms of empirical work, there is a broad body of evidence from India suggesting that the gender of a politician has a

[2]For example, the data includes over over 5,200 candidate-election pairs who win or lose by less than 0.5 percent of total votes cast.

significant effect on policy. Chattopadhyay and Duflo (2004) found that when a third of village council head positions were randomly reserved for women in West Bengal and Rajasthan, councils with a female head invested more in drinking water than men who generally invested more in infrastructure such as roads. Clots-Figueras (2011) used close elections between women and men in 16 Indian states (between 1967 and 2000), and found that female representatives were associated with greater investment in health and early education, along with support for more gender equality (such as the Hindu Succession Act).

There is also evidence of a gender difference in policy preferences: Aidt and Dallal (2008) found an increase in social spending attributable to women's suffrage in Western Europe between 1869 and 1960, which Bertocchi (2011) also finds in other countries in a similar time frame. Svaleryd (2009) uses survey data from Swedish municipalities and finds differences in policy preferences across gender, and greater female representation is therefore associated with greater spending on childcare and education. More recently, Funk and Gathmann (2015) presented data from Switzerland (and its direct democratic system) between 1981 and 2003 that indicated that women were 10 percentage points more likely to support environmental spending and 6 percentage points less likely to support military spending, although these results from Europe are less obviously found in the U.S. (for example, Ferreira and Gyourko (2014)). Focusing on 1970 to 2000, Koch and Fulton (2011) find that female legislative representation decreases defence spending (although female executive representation increased defence spending), although they do not totally eliminate potential endogeneity bias from cross-country comparisons.

Furthermore, there is evidence suggesting that female representation has an effect on policy outcomes. Clots-Figueras (2012) found that female representation increases probability of completing primary education in India. In the U.S. women's suffrage led to 8 to 15 percentage decreases in child mortality between 1869 and 1920 (Miller, 2008), and this is supported by evidence in India (Bhalotra and Clots-Figueras, 2014). The use of gender quotas in party candidate lists (especially in Scandinavian countries), with recent empirical evidence suggesting that they have a positive effect on the quality of male politicians (Besley et al., 2017) and cue parties to prioritise gender equality issues (Catalano Weeks, 2019) (although (Geys and Sørensen, 2019) found that in the case of Norway's 1992 quota there was no significant effect on policy). Finally, Brollo

and Troiano (2016) suggests that female mayors are less prone to corruption than male ones in Brazil.

Contributions to the Literature I address two strands of the political economy literature concerned with political representation: exploring the reasons for inequality in representation in politics, and more specifically spillover effects in the representation of historically under-represented groups.

This chapter contributes to a body of work that debates why women have been persistently under-represented in politics, some of which is also outlined in the previous chapter. Much work in this literature focuses on gender bias - Bhalotra et al. (2018) find evidence of gender bias that influences female representation (both the number of female legislators and female candidates) from socially conservative Indian electorates. However, the effects of gender bias on female representation in the U.S. is less obvious empirically. Even if one were to find the probability of election being similar between female and male candidates, this does not rule out voter gender bias, as Fulton (2012) notes. Using surveys of local political activists as a measure of political ability, she concludes that women tend to be more qualified than men before choosing to run for office and that this implies a voter bias. Kahn (1996) argues that gender stereotypes are significant in political campaigns, and Sanbonmatsu and Dolan (2009) finds in survey data that gender stereotypes are prevalent in both of the major U.S. political parties. However, using close primary election of women[3] in the U.S. House of Representatives between 1982 and 2002, Anastasopoulos (2016) conclude that women do not receive less of the vote at the general election or receive less campaign contributions than their male counterparts. Outside of the U.S., Folke and Rickne (2016) finds that female politicians in Sweden are less likely to be promoted within political parties even accounting for characteristics such as experience. The introduction of term limits to some legislatures has been posited as an opportunity for more women to replace long-incumbent men (the literature summarised by Labonne et al. (2021)), but there is no consensus that the introduction of term limits aids female representation, for example beyond furthering family political dynasties, as found in the Philippines (Labonne et al., 2021).

In exploring inequalities in representation between men and women, I also contribute to the wider literature concerning inequalities in representation in other dimensions. This is relevant to other settings, such as in business, where there is evidence of discrimination

[3]Where the primary election of a woman is the case a political party votes to choose a female candidate to represent them in the general election for certain district.

or bias (Bertrand and Mullainathan, 2004). Within politics, there is empirical evidence that minorities can have different policy preferences (Beach and Jones, 2017; Bhalotra et al., 2018), for example black mayors of U.S. cities hire more black police officers (Hopkins and McCabe, 2012), which is especially pertinent given their chronic under-representation in the police force. In particular, political representation of groups that are traditionally under-represented can reduce inequality (Beach et al., 2019). As with the literature concerned about under-representation of women in politics, there is mixed evidence about the existence of a virtuous circle in politics for other minorities (Banducci et al., 2004; Bhalotra et al., 2018).

This chapter most closely contributes to the literature concerned with a spillover effect of representation of a historically under-represented group: for example, women in politics. Women winning elections in the present could increase women running for and winning elections in the future: a 'virtuous cycle' (Iyer, 2019). Evidence for such a virtuous cycle is mixed across the world. Empirical studies from India suggest that female representation, whether as a result of quotas (Beaman et al., 2009) or close election of women (Bhalotra et al., 2018), increases female representation in the future, although Bhalotra et al. (2018) finds that female incumbents crowd out potential newcomers. I find similar results in the short term, but this crowding out fades in the long term as new female candidates appear.

There are similarly positive results from Germany, where Baskaran and Hessami (2018) uses close elections of female mayors in Germany (between 2001 and 2016) to illustrate a trickle-down effect: female mayors lead to more female candidates and winners in local councils and neighbouring municipalities. In the U.S. however, there is scant evidence of a spillover effect from the election of women, whether using data from state legislatures between 2002-2008 (Broockman, 2014) or mayoral elections between 1950-2005 (Ferreira and Gyourko, 2014). In particular, Broockman (2014) finds no significant effect on female turnout. Although he identifies a positive (and significant) effect on the probability of a woman running for office in that particular district in the next election, he concludes this is largely driven by female incumbents running for re-election. Further, he finds no spillover effect on nearby districts on female candidacy, but this may be driven by an incumbency advantage. While I confirm that the short-term spillover is largely driven by the re-election of female incumbents, I contribute to the literature by finding that the positive long-term spillover is also driven by new female candidates.

I extend this analysis in several ways. Firstly, my analysis allows for the comparison of short-term and long-term spillover effects: both across time within a district and across the state, whereas (Broockman, 2014) restricts the analysis to the impact on the next election. Although this identifies the short-term influence of female incumbents running for re-election, it may miss a longer-term increase in female representation due to new female candidates who replace the incumbents. Secondly, rather than focusing on neighbouring districts, I test for a statewide spillover effect. Thirdly, and most obviously, I extend the sample from 3,813 elections between 2002 and 2008 to 143,149 elections between 1968 to 2016. This allows me to test long-term impacts of a woman being elected to office for future female representation. Fourthly, I am also able to analyse 40 times as many elections as the identification strategy in this chapter does not solely rely on variation in close elections between one man and one woman. Applying an instrument variable approach of Hyytinen et al. (2018) to the US political system, I am able to use variation in women winning or losing by small margins in a wider range of elections.

Chapter Layout The chapter follows with Section 3.2 outlining the institutional context of the data within US state legislatures; Section 3.3 explains the empirical strategy; Section 3.4 presents the results estimating temporal spillovers; Section 3.5 discusses potential transmission mechanisms; Section 3.6 presents the results estimating geographical spillovers; Section 3.7 concludes.

3.2 US State Legislatures: Institutional Context and Data

Each of the fifty U.S. states has its own state legislature: with the exception of Nebraska all of them have a bicameral legislature (two chambers) - a larger/lower chamber usually labelled the House of Representatives and a smaller/upper chamber usually labelled the Senate, which mirrors the US Congress in Washington DC. As a result, there are a total of 99 state chambers. These state legislatures have control over a variety of policy areas, such as spending on education, health, transport, and utilities (Aidt and Shvets, 2012).

The 19th Amendment of 1920 prohibited the denial of the right to vote in federal and state elections on the basis of sex, although a few women had been elected to

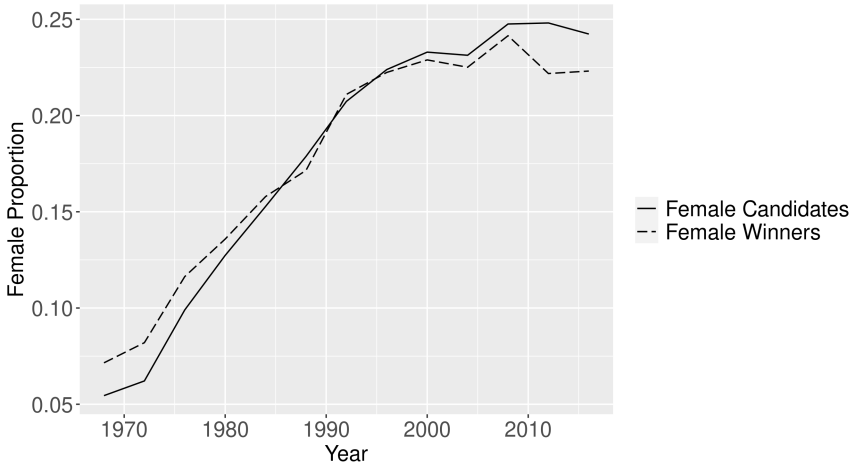
office previously (Jeanette Rankin was elected to the U.S. House of Representatives in 1916 and three women were elected to the Colorado House of Representatives in 1894). However, female representation in U.S. politics generally grew slowly in the first half of the twentieth century, with only a handful of women being elected even forty years after women were given the right to vote. This would change in the late 1960s and early 1970s, where the time period of the data in this chapter begins.

The data used is the state election returns collected by Klarner et al. (2018), which reports information on state legislative election results from 1967 to 2016, which includes 261,842 candidate-election pairs. This includes state election returns from all 99 state chambers, although some state returns are not available until the mid-1970s. Out of the 143,149 district-election pairs, 132,519 (92.6 percent) concern single-member districts (one candidate is elected into office), and the rest are multi-member districts (where multiple candidates are elected for the district). Most importantly it provides (among other information) names, political affiliation, date of election, votes cast for a candidate, whether they were an incumbent, and whether they won election, and information about the district (such as redistricting regime, state chamber, and the number elected into office). However, they do not report the gender of the candidates, so I use a dataset of over 95,000 different US first names assigned to gender by Howard (2016) to estimate the gender of the candidates. This dataset is created using data from the Social Security Administration which provided genders and first names for any names that appeared more than 5 times in a year from 1930 to 2015.

The proportion of candidates and winners who are female is 18.1 percent and 18.3 percent, respectively. However, these averages mask a general positive trend in female representation from the start of the sample in the late 1960s, which is illustrated by Figure 3.1 - an increase in female representation is also seen across all fifty states' state legislatures in Figure 3.2. While all fifty states see an increase, there remains considerable variation: states' female proportion of candidates since 2000 varies between 7.4 and 33.9 percent.

Figure 3.1 shows that the female proportion of candidates and winners has grown from between 5 and 10 percent in the early 1970s to over 20 percent by the end of the sample. On the other hand, this growth has stagnated towards the end of the sample: it is unclear whether increases in female representation appear to lead to further increases, despite women remaining significantly under-represented.

Fig. 3.1 Female Representation Across Time



3.3 Empirical Strategy

In this section I outline the OLS specification, introduce the salient variables and estimated parameters, and explain potential endogeneity problems with the specification. I then propose an IV strategy that exploits the close election and non-election of women, which is the preferred identification strategy for the remainder of the paper.

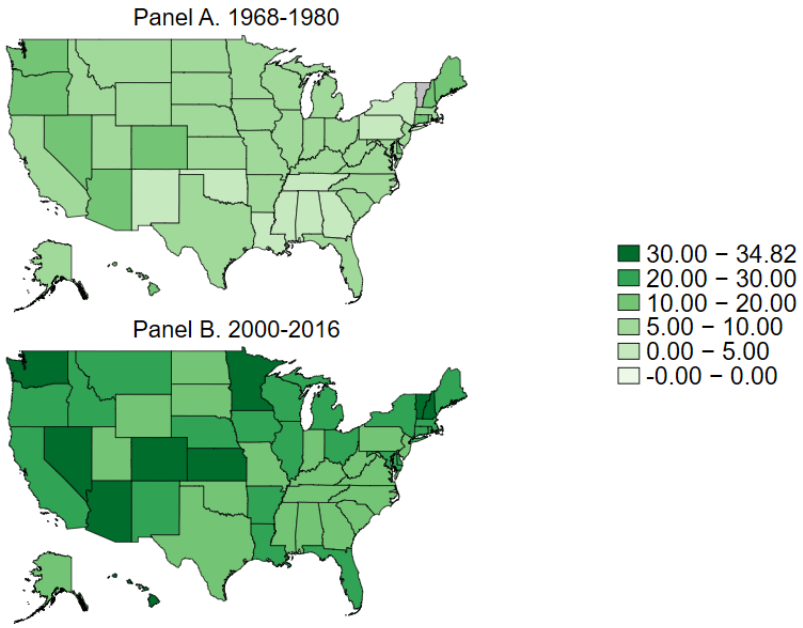
3.3.1 OLS Specification

I test whether the election of a woman influences female representation in the following election. The OLS specification takes the following form:

$$Fem_{id,t+1} = \alpha + \beta FemWin_{dt} + \epsilon_{id,t+1} \tag{3.1}$$

The unit of observation is the candidate-district-election. The explanatory variable, $FemWin_{dt}$ is the number of women who won (were elected) in district d in election t. I assume that a district d is distinct to a similarly named or numbered district in another redistricting regime. Every decade after the US Census, state legislatures redraw the boundaries of state senate and house districts, so the decade in between each change is a redistricting regime. The result of this redistricting is that a district, such as the 1st District of the Texas State House of Representatives, in one year, such as 1980, may have significantly different geographical boundaries to the similarly named district in the present day. There is considerable variation in redistricting changes across time

Fig. 3.2 Female Representation Across States (Percentage of all Winners)



and across states, such as what the specified guidelines are. For example, as Forgette et al. (2009) note, states such as Washington and Arizona require that the redrawing of boundaries encourage electoral competitiveness, while others states such as South Carolina prioritise keeping a district's population 'core', such as an urban area, when redrawing its boundaries. As a result, I choose to define the observational unit of a district as distinct between redistricting regimes[4].

I normalise $FemWin_{dt}$ by the total number of winners in the district-election pair dt, Win_{dt}, to avoid heteroskedasticity as I include multi-member districts where multiple winners are elected. Therefore the variable $FemWin_{dt}$ can be interpreted as the proportion of winners who are women between (and including) zero and one. In a single-member district it is effectively a binary variable indicating whether a woman won or not.

The variable $Fem_{id,t+1}$ is a binary variable that denotes whether candidate i running in district d at the next election $t+1$ is a woman (value of one) or not (value of zero). The coefficient of interest is β, which represents the effect of a woman winning in

[4]An example of district boundaries changes in the Wisconsin State Senate between 2008 and 2018 can be found here: https://www.theguardian.com/us-news/2020/nov/02/us-election-2020-gerrymandering-state-races-that-will-define-decades-politics.

election t on the likelihood that a candidate running in the district's next election $t+1$ is female.

The interpretation of β differs depending on the sample of candidates included. If the sample includes **all candidates**, then β_1 can be interpreted as the effect on the future proportion of candidates who are female. If the sample only includes **winning candidates**, then β can be interpreted as the effect on the future proportion of winners who are female.

However, this OLS specification may suffer from a selection bias. For example, the election of a woman in election t and more female candidates in election $t+1$ may both be linked to voters' preferences concerning female representation. This is likely to bias the OLS estimates of β upwards, and overestimate the impact of the election of a woman on female representation at the next election. Further, even if geographical fixed effects (for example state fixed effects) are included, the preferences of the voters may change at different rates between geographical units. For instance, some states' voters may have responded to the women's liberation movement of the 1970s differently, as the Equal Rights Amendment that sought guarantee equal legal rights regardless of sex was followed by polarisation (Miller, 2015) that has led to its continued non-ratification. These differences may exacerbate the bias in the OLS estimation.

3.3.2 Instrumental Variable Specification

Instrument Variable: I construct an instrument variable that exploits quasi-random variation in the election of female candidates that arises from close elections. Applying the method that Hyytinen et al. (2018) use to majoritarian/first-past-the-post elections, the instrument is the difference between the number of women elected by a small margin and the expected number of women elected by a small margin, in a given election in a district. The instrument, $NetCloseFemWin_{dt}$ is defined as follows, where the unit of observation is the district-election pair:

$$NetCloseFemWin_{dt} = CloseFemWin_{dt} - ExpCloseFemWin_{dt} \tag{3.2}$$

$CloseFemWin_{dt}$ is the number of women who won by a close margin in district d at election t I define the (vote) margin of candidate as being the percentage of total votes cast that would need to be taken away from the candidate to alter their outcome.

For a successful candidate, this would be the difference in their vote share and the vote share of the candidate with the greatest vote share among the unsuccessful votes: this would be positive. For an unsuccessful candidate, it is the difference in vote share between the candidate with the smallest vote share among the successful candidates and the candidate's: this would be negative. This definition, and the calculation of the instrument, allow for the wider use of variation in female election beyond the case of one woman winning or losing an election against one man for one seat in the state chamber. I further define a winning or losing by a small margin as the absolute vote margin being smaller than a certain percentage of total votes cast (for example 2 percent). $ExpCloseFemWin_{dt}$ is defined as the following:

$$ExpCloseFemWin_{dt} = \frac{CloseWin_{dt}}{Close_{dt}} \times CloseFem_{dt} \tag{3.3}$$

$CloseFem_{dt}$ is the number of women who won or lost by a small margin in district d at election t; $Close_{dt}$ is the number of candidates (both male and female) who won or lost by a small margin; $CloseWin_{dt}$ is the number of candidates (both male and female) who won by a close margin. The variable $ExpCloseFemWin_{dt}$ calculates the expected number of female winners by taking the number of women won or lost by a small margin, and multiplying it by the proportion of all candidates (male and female) involved in close races who won. Importantly, I assume that once a candidate is involved in a close race, their assignment as a successful or unsuccessful candidate is as good as random, with the probability of their election $CloseWin_{dt}/Close_{dt}$.

This instrument can be illustrated by an example. Suppose that in an election, there are three marginal candidates (win or lose by a small margin): Candidate A is female and is successful, Candidate B is male and successful, and Candidate C is female and unsuccessful. The expected number of women winning by a small margin according to (3.3) is $\frac{2}{3} \times 2 = \frac{4}{3}$, as there are two women and three candidates in total winning or losing by a small margin, and there are two seats 'available' (there may be another successful candidate D who has won by a large margin, and there may be another unsuccessful candidate E who has lost by a large margin). Therefore $NetCloseFemWin$, the instrument as defined by (3.2), is equal to $1 - \frac{4}{3} = -\frac{1}{3}$. As Hyytinen et al. (2018) suggest, if $NetCloseFemWin$ is positive, women in those close races are relatively 'lucky' and if it is negative, women in those close races are relatively 'unlucky'.

First-Stage Specification: The first-stage specification identifies variation in female election that is driven by differences between the number of women who are elected by a small margin and how many one would expect to see elected in by a small margin. The reason why that difference is necessary, as opposed to just using the number of women elected by a small margin, is that it accounts for the female proportion of these marginal candidates, as well as the number of these marginal candidates. If they were not accounted for, then the very same unobserved heterogeneity that may bias the OLS estimates may also be correlated to both the number of women getting elected by small margins (as there needs to be a female candidate for this to happen in the first place) and future female representation. As a result, the first-stage specification is defined as:

$$FemWin_{dt} = \gamma_s + \gamma_t + \delta NetFemCloseWin_{dt} + + u_{dt} \tag{3.4}$$

The unit of observation is the district-election pair, state and year fixed effects are included, and the errors are clustered at the district level. As with the OLS specification, the district d is distinct between redistricting regimes. In addition, both variables are normalised by the number of winners in the election in district d at election t, similarly to the OLS specification.

Second-Stage Specification: The second-stage specification which takes predicted values from the first stage, is the following:

$$Fem_{id,t+1} = \alpha_s + \alpha_t + \beta \widehat{FemWin}_{dt} + \epsilon_{id,t+1} \tag{3.5}$$

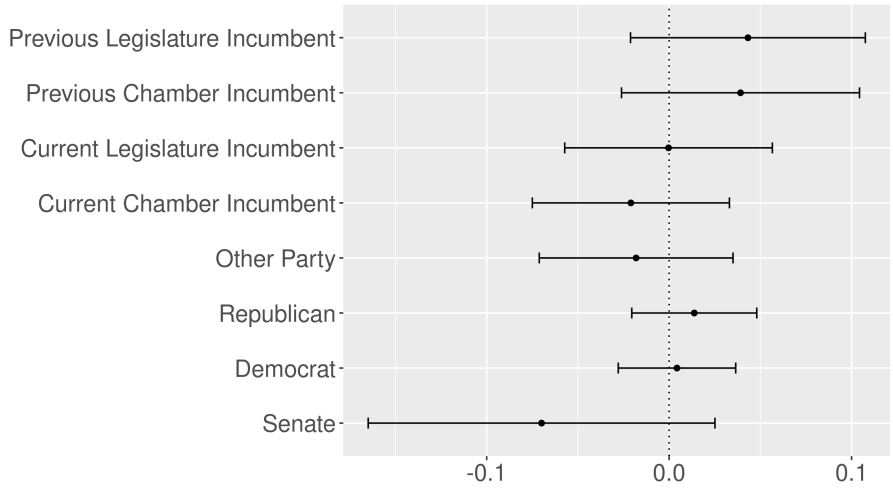
Predicted values of $FemWin_{dt}$ are taken from the first-stage specification and denoted as $\widehat{FemWin}_{dt}$. Just as in the first-stage specification, state and year fixed effects are included, and the errors are clustered at the district level. The specification defined in (3.5) is the preferred specification for the empirical analysis.

3.3.3 Instrument: Net Close Female Elections

The conditional independence assumption is that differences between the number and expected number of women elected by a small margin in election t is independent to female representation in the next election in $t + 1$. This assumption is satisfied if the

assignment of winning/losing elections (given a candidate is within a small margin) is as good as random - this is more likely to be fulfilled the smaller one defines a 'small margin'.

Fig. 3.3 Balance Tests

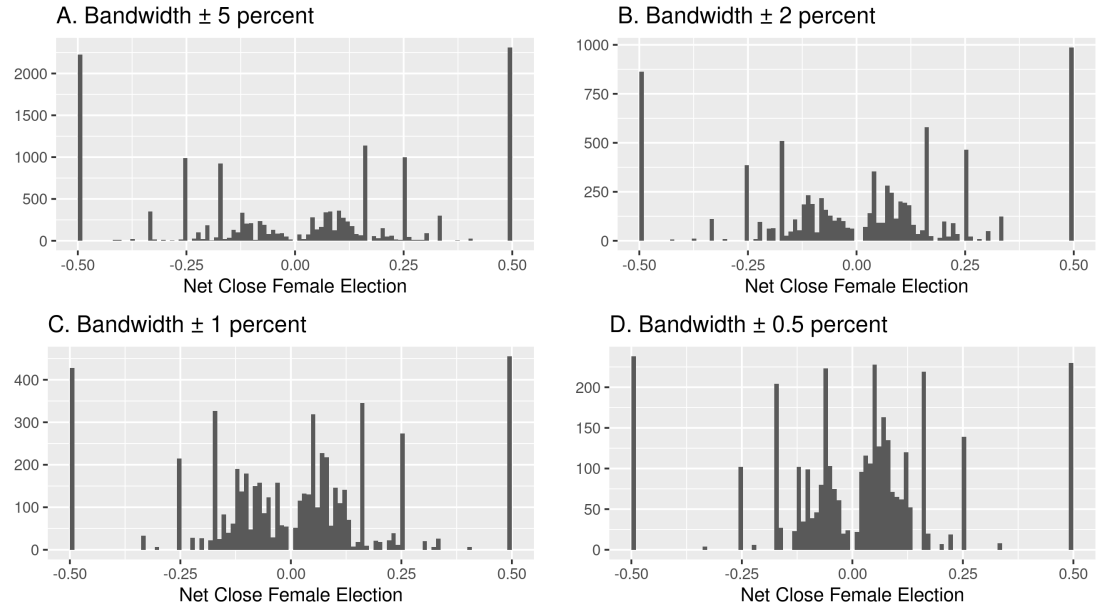


This figure illustrates the coefficient of the instrument when regressing different characteristics on the instrument. Previous Legislature and Previous Chamber Incumbent indicate whether the candidate was previously an incumbent of the legislature or the specific chamber that the district lies in, while Current Legislature and Chamber Incumbents are current incumbents who are running for re-election. Other Party, Republican, and Democrat dummies indicate whether the candidate is running as a candidate for one of those parties, and the Senate dummy indicates whether the district is part of the state senate (value of one) or the state house (value of zero).

To test whether this assumption is likely to hold, I run a balance test on election characteristics. I test whether variation in the instrument is correlated to these characteristics, and I present the results in Figure 3.3. Figure 3.3 does not appear to provide any evidence that the instrument is correlated to any of the observed characteristics. For example, there do not appear to be more women than expected winning in close state senate races compared to close state house races, and women do not appear to be more likely than expected to win close elections when an incumbent is running for election.

Further, evidence from Figure 3.4 suggests the instrument is symmetric around zero, as one would expect. This is important, as an asymmetric distribution of the instrument around zero would imply that the number of women winning by a small margin is either systematically higher or lower than the expected number. The symmetry found in Figure 3.4 supports the assumption of random assignment of victory conditional on

Fig. 3.4 Instrument Distribution - Zeroes Omitted



This figure illustrates the distribution of the instrument, with values of zero omitted to focus on the symmetry between the left and right hand sides. Each panel defines a 'small margin' by a certain margin or bandwidth - for example, Panel D. defines a small margin as an absolute vote margin of less than half a percent of total votes cast.

a small margin/close race. In addition, the first stage regressions, which are presented in Panel A of Table C.1, suggest that an additional woman elected in by a small margin increases the the number of women winning in a one-to-one relationship, which one would expect (the estimated coefficient, which is δ in (3.4), is not significantly different to zero). Further, the F-statistics from the first-stage results range between 83 and 210, suggesting the instrument's validity. Finally, I estimate the baseline specification across a number of small margins. These margins are 10 percent (23.6 percent of observations), 5 percent (13.8 percent), 2 percent (6.5 percent), 1 percent (3.5 percent), and 0.5 percent (1.8 percent). I find that the results are robust to different assumptions.

3.4 Temporal Spillovers

I present the results of the baseline specification in Table 3.1. Panel A displays the impact of a woman getting elected on the likelihood that a candidate in the next election is female, while Panel B shows the impact on the likelihood that a winner at the next election is female. Column 1 presents the estimate from the OLS specification,

while Columns 2 to 6 present estimates from the second-stage specification for different definitions of a 'small margin'.

Table 3.1 Impact of Female Candidate Election on Future Female Candidacy

	Dependent variable:					
	Future Female Representation Outcome					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Female Proportion of Future Candidates						
Female Winners	0.438***	0.283***	0.269***	0.286***	0.266***	0.240***
	(0.003)	(0.009)	(0.011)	(0.017)	(0.024)	(0.036)
Bandwidth (+/-)	N/A	10 percent	5 percent	2 percent	1 percent	0.5 percent
Observations	206,154	206,154	206,154	206,154	206,154	206,154
Adjusted R^2	0.191	0.039	0.036	0.034	0.033	0.033
Panel B: Female Proportion of Future Winners						
Female Winners	0.764***	0.571***	0.519***	0.503***	0.458***	0.444***
	(0.003)	(0.013)	(0.018)	(0.027)	(0.038)	(0.056)
Bandwidth (+/-)	N/A	10 percent	5 percent	2 percent	1 percent	0.5 percent
Observations	111,483	111,483	111,483	111,483	111,483	111,483
Adjusted R^2	0.514	0.066	0.053	0.047	0.044	0.043

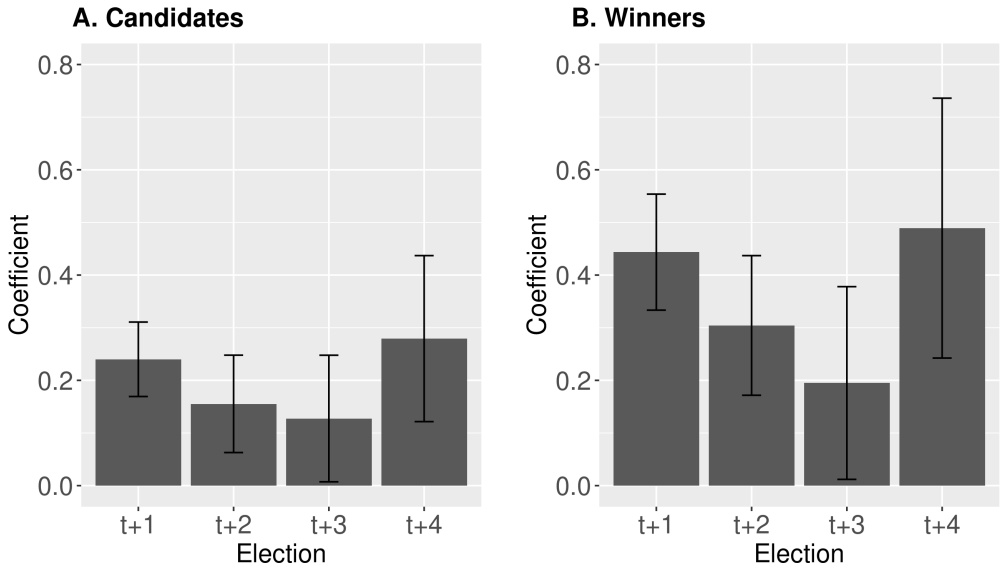
Notes: This table reports the estimated impact of the election of a woman in a district on female. representation in the district at the next election. The unit of observation is the candidate-district-election. The dependent variable is a binary variable that takes a value of one if the candidate is a woman, and a value of zero otherwise. The specifications in Panel A include all candidates, whereas in Panel B the sample is restricted to candidates who are elected into office at that election. Column 1 reports the OLS estimates, while Columns 2 to 6 report the IV estimates across a range of different definitions of a 'small margin', or bandwidths, for the first stage specification. All specifications included year and state fixed effects. Standard errors, which are clustered at the district level, are reported in parentheses. Significance levels are denoted as follows: *p<0.1; **p<0.05; ***p<0.01

Table 3.1 suggests that there is a positive spillover effect into the next election. The difference between the OLS estimates of Column 1 and the IV estimates of the other Columns support the argument made previously that the OLS estimates suffer from a positive bias. Nonetheless, the preferred estimates are significant at the 1 percent level, positive, and robust across different definitions of a small margin. For the ease of interpretation, assume a single-member district: the election of a woman is estimated to increase the proportion of candidates who are female at the next election by 24.0 to

28.3 percentage points[5]. This is the equivalent of more than doubling (132 percent) the likelihood of a female candidate in the average district. An even greater effect is found for female representation among those elected at the next election (44.4 to 57.1 percentage points).

I investigate the longer-term impact of the election of a woman to office on female candidacy and election in subsequent elections. The results are shown in Figure 3.5, and I assume for the remainder of the chapter the definition of a small margin as being less than 0.5 percent.

Fig. 3.5 Effect of Female Election on Future Female Representation



This figure shows the longer-term effect of the election of a woman in election t on future female representation among candidates (Panel A) and among winners (Panel B) in the district. The coefficient estimates and their corresponding 95 percent confidence intervals are presented. The accompanying results can be found in Table C.2.

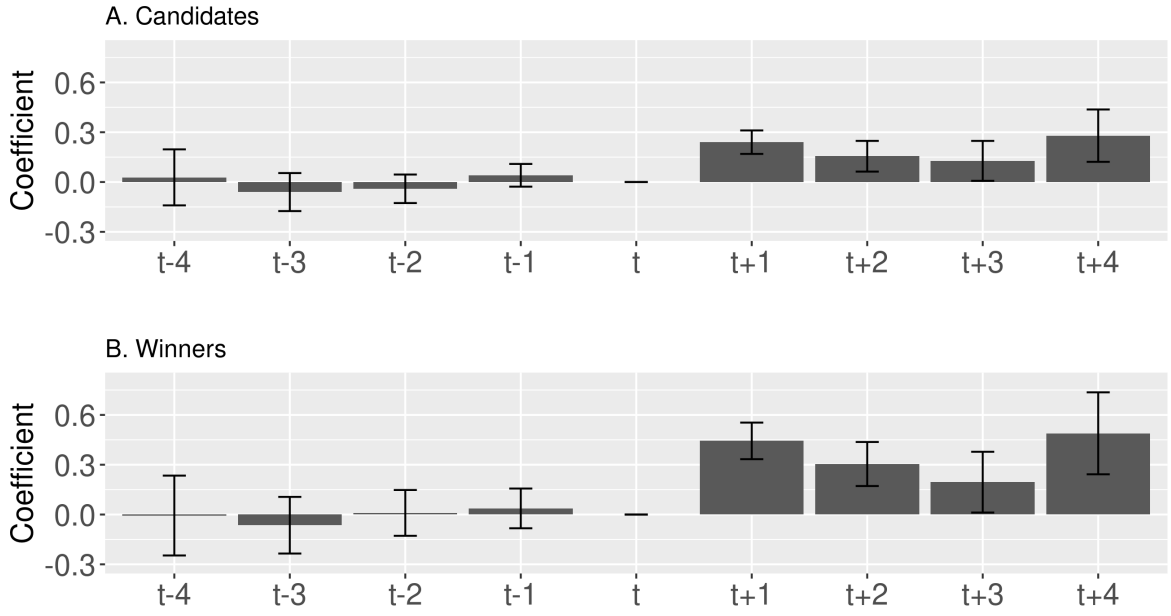
The impact on female representation is similar for future female candidacy and for female winners. The positive spillover remains significant at the 5 percent level across time, even four elections after the initial election of a woman. However, for the first three elections the positive spillover effect appears to somewhat fade to around half the initial impact: 24.0 to 12.8 percentage points by the third election after for female candidacy, and 44.4 to 19.5 percentage points for female winners. Despite this, the

[5]If the district elects two candidates to a state chamber, then this would be the effect if the two successful candidates were women, as the explanatory variable is normalised by the total number of winners.

long-term impact after four elections appears to pick up after a few election cycles of decline[6]. After four election cycles the influence of the original election of a woman increases around the same magnitude as the short-term or one-election impact. These trends do not appear to be significantly different between the two major political parties as shown in Table C.5.

As a falsification test, I test the correlation of female election with female representation at *previous* elections. I present the estimated effects before and after the 'treatment' of an woman being elected at election t in Figure 3.6.

Fig. 3.6 Pre-Treatment and Post-Treatment Effect



This figure presents the pre- and post-treatment effect of a woman being elected to office in a given district, which is the treatment at election t (pre-treatment ranges from four to one election before, post-treatment one to four elections after). The coefficient estimates and their respective 95 percent confidence intervals are estimated using the baseline specification.

Reassuringly, there appears to be no significant effect before the treatment period at election t. This suggests that there are no anticipation effects and that the close of election of a woman (compared to the expected number of women winning by a close margin) is not correlated to past female representation in the district. One

[6]I do not estimate longer-term effects due to there being relatively few cases where the same district has had many more than four elections before redistricting.

would not expect either to be the case if variation in the instrument was indeed quasi-random.

3.5 Transmission Mechanisms: Incumbents and New Candidates

Among others, there may be two important transmission mechanisms through which the election of a woman may increase female representation in future elections in the district. The first is simply an incumbency advantage: once a woman is elected they, like their male colleagues, may enjoy an incumbency advantage at future elections that is well documented, for example by Hainmueller et al. (2015). As a result, the increase in female representation in the future may be partly due to the same woman running for re-election, and in addition being more likely to win re-election due to an incumbency advantage.

A second transmission mechanism may be the influence of a woman getting elected on new female candidates. This mechanisms may influence every part of the 'supply chain' of female representation. For example, the election of a woman to office may encourage other potential female candidates to run for office. In addition, it may influence political parties' choice of candidates, and be more likely to choose female candidates in the future when it selects new candidates. Finally, it may influence voter attitudes towards female candidates, and make them more likely to vote for a female candidate.

This spillover effect onto new candidates has several interpretations, which I am not able to disaggregate between. One explanation may be that a woman serving her term in office results in candidates, parties, and voters updating their beliefs about women's ability to serve in office (Beaman et al., 2009). The effect described by this explanation could be positive or negative, depending on attitudes toward the female incumbent's performance in office, although Beaman et al. (2009) suggest that the election of a woman may have, on average, a positive effect as it dampens voters' risk aversion concerning female candidates. Another explanation may be that having more women elected increases the likelihood of a woman being selected as a new candidate as women may be more likely to suggest that their party selects more female candidates for the next election. For instance, incumbent who decides not to run for re-election may have

some influence in suggesting a replacement to run for their party in the district that she has served in.

Additionally, one explanation may be an increase in the perceived 'electability' of women - this might mean that female candidates (and the parties that select) believe that they have a more realistic chance of election and therefore run (or select them). However, I place less emphasis on this explanation due to the chosen empirical specification which exploits variation in the close election or non-election of women. The variation in the instrument comes from small margins: one may not believe that women are significantly more 'electable' upon observing a woman win by 0.5 percent of the vote compared to the case where they observe that woman losing by 0.5 percent.

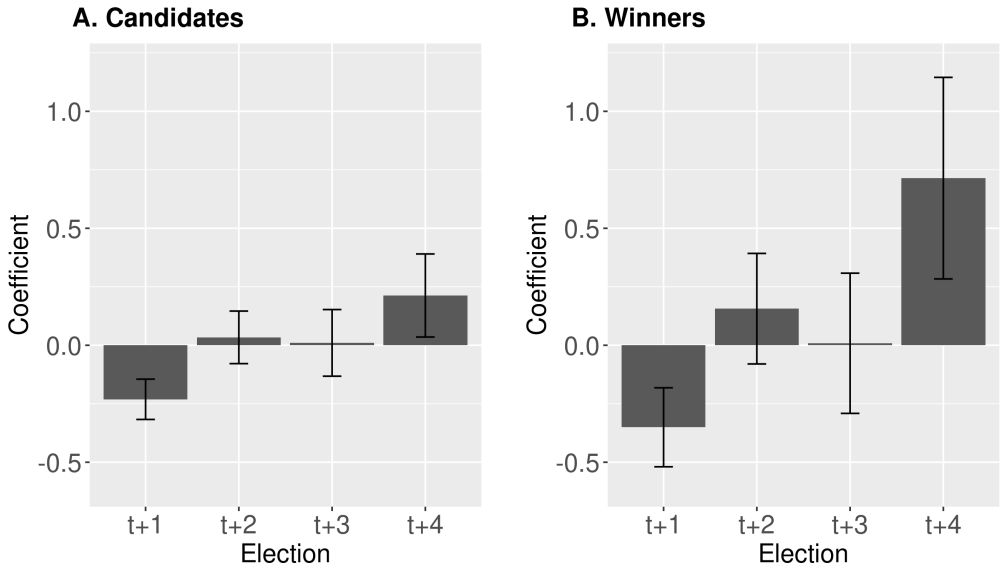
Although I am unable to separate the various explanations concerning new candidates, I am able to disaggregate the effect of a electing a woman between the incumbency advantage mechanism and the new candidate mechanism[7]. I define a 'new candidate' as one who is not currently an incumbent in the same state chamber[8].

Figure 3.7 illustrates the impact on new candidates. Panel A presents the impact of on the proportion of new candidates who are female, while Panel B shows the effect on the proportion of new winners who are women. Both Panel A and Panel B suggest that for three election cycles there is no significantly positive effect on female representation among these new candidates and winners. In fact, there appears to be a negative effect in the short run. In a simplistic case of elections between one Democrat candidate and one Republican candidate, where the woman elected in election t runs for re-election in election $t+1$, these results suggest that there is no evidence of a positive spillover effect across party lines. However, there appears to be a positive long-term effect four election cycles after the initial election of a woman. This long-term increase in female representation among new winners is greater than the increase in female representation among new candidates, which suggests that the probability of a given female candidate winning an election increases in the long run. This would be consistent with political agents (voters, parties, and candidates) updating their beliefs about the ability of women as elected officials, as found by Beaman et al. (2009).

[7]I use the latter as a catch-all term for the various explanations concerning new candidates.

[8]This takes into account incumbents who are in office at the end of a redistricting regime who run for re-election in the same state chamber at the beginning of the next redistricting regime. I would miss these cases I were to only include those who were an incumbent in the district at the previous election, as I treat the same numbered/named district as distinct between redistricting regimes.

Fig. 3.7 Impact on New Female Candidates



This figure illustrates the impact of a woman being elected on female representation among candidates who are not incumbents up to four elections afterwards. The coefficient estimates and their corresponding 95 percent confidence intervals are presented. The regression results can be found in Table C.3.

This relatively long 'response time' may be driven by two factors. On one hand, newly-inspired prospective candidates may take time preparing to run for office and get more experience in campaigning (such as volunteering for another candidate), especially if the political party requires them to do so. A second factor may be that newly-interested female candidates may choose to wait until the current incumbent does not run for re-election, given a considerable incumbency advantage in US politics. Separating these preparation and waiting factors would be difficult, even with primary election data.

These results suggest that in the short run, the temporal spillover effect is driven by the same female incumbent running for re-election, but that in the long run it is driven by an increase in new female candidates.

3.6 Geographical Spillovers

Alongside temporal spillovers in female representation, within a given district, I also investigate geographical spillovers. I test whether the election of a woman in a district at election t influences the likelihood that a given candidate or winner in other districts

within the same state chamber are women. While Broockman (2014) focuses on nearby districts, I test whether increases in female representation within the state chamber influences female representation for a given district within that state chamber.

The election of a woman in a district may influence female representation in neighbouring districts, but may also influence female representation across the state. This may be due to the centralised influence of political parties in the state legislature in selecting and aiding candidates. Members of the political party may use their influence to endorse primary candidates across their state legislature, while the political party committee may use its financial resources for election campaigns within the state legislature to win a majority (Hogan, 2007). As a result, the election of a woman in one district may influence whether women run for office or win in other districts within the legislature beyond neighbouring districts. Furthermore, the geographical spillover from news media coverage may cover an area beyond neighbouring districts, as the consumption of local news coverage has declined in recent decades (Moskowitz, 2021). The election of women across the state may be reported across a wider audience than their respective neighbouring districts.

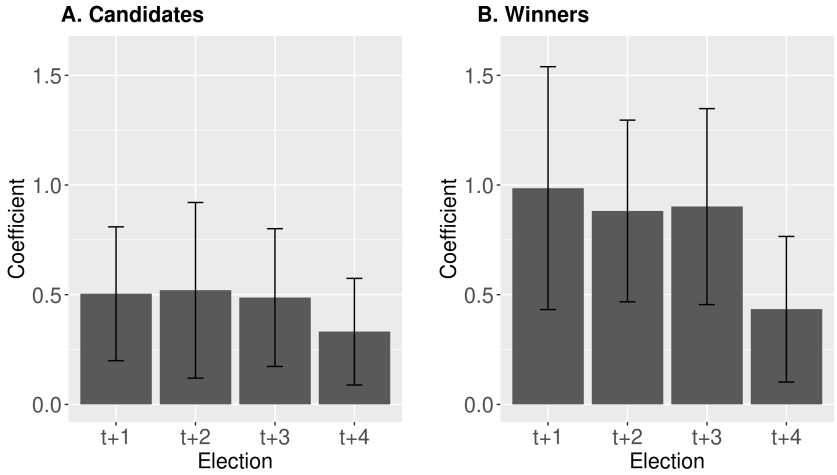
The first stage specification of (3.4) is altered so that the unit of observation is the state chamber (for example the Texas State Senate), and the variables are normalised by the total number of winners in the state chamber at that election[9]. The second-stage specification is defined as the following:

$$Fem_{id,t+k} = \alpha_s + \alpha_t + \beta_k \widehat{FemWin}_{ct} + \epsilon_{id,t+k} \tag{3.6}$$

Where $\widehat{FemWin}_{ct}$ is the first-stage predicted value of the number of women winning elections in state chamber c at election t, normalised by the total number of winners in the state chamber at election t. Given that variation of the treatment is at the state chamber level, the errors are clustered also at the level of the state chamber. Therefore the coefficient β_k represents the effect of more women being elected in state chamber c on female representation in k elections' time in the districts within the state chamber.

[9]I remove chamber-election pairs where fewer than 10 percent of the seats are up for election to ensure that an election that consists of small number of by-elections does not have a disproportionate influence on the estimates.

Fig. 3.8 Geographical Spillovers: All Candidates



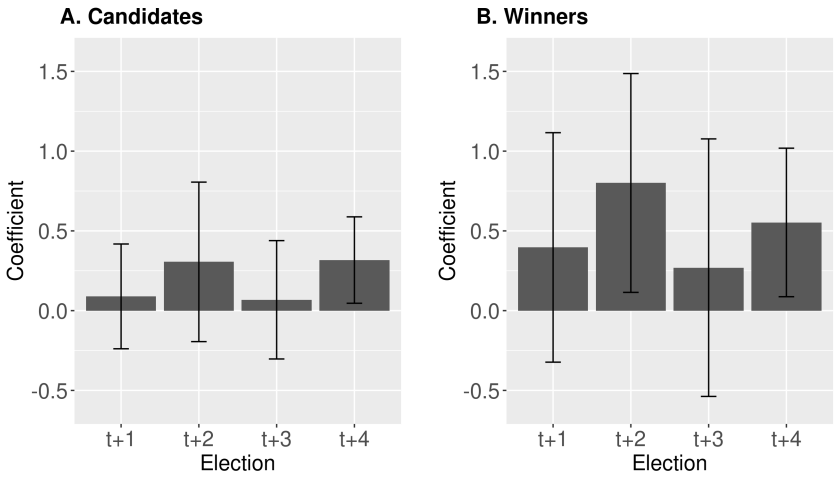
This figure depicts the results of the second-stage specification outlined in (3.6), for four elections after the treatment election t. Panels A and B present the impact on future female representation among candidates and winners, respectively, along with 95 percent confidence intervals. The corresponding regression results can be found in Table C.4.

Figure 3.8 illustrates the results across future elections. Panel A suggests that there is a positive and significant geographical spillover effect within the state chamber. The estimated coefficient is around 0.5 (between 0.487 and 0.520) for the next three elections, falling to 0.331 at the fourth election. Given that the explanatory variable $\widehat{FemWin}_{ct}$ is normalised by the total number of winners in the chamber-election pair, the interpretation of the estimates is different to the interpretation of coefficient estimates in previous sections - it is the increase in future female representation if all the elections at election t in chamber c were won by women.

Therefore, to estimate the average impact of one woman being elected in a district on other districts in the state chamber, one would divide the coefficient by the average number of districts in a state chamber (75.4). As a result, the geographical spillover of one district electing a woman is an increase of between 0.65 and 0.67 percentage points in female representation among candidates in the next three elections, which falls to 0.44 by the fourth. Female representation among candidates is on average 18.1 percent in the sample, so these effects are the equivalent to an increase of 3.6-3.7 percent initially, falling to 2.4 percent.

Panel B suggests an even greater geographical spillover effect for female representation among future election winners. This follows a similar trend to Panel A: for the next three elections there is a positive and significant effect of 1.17 to 1.31 percentage points

Fig. 3.9 Geographical Spillovers: New Candidates



This figure depicts the results of the second-stage specification outlined in (3.6), for four elections after the treatment election t. Panels A and B present the impact on future female representation among candidates and winners who are not incumbents, respectively, along with 95 percent confidence intervals. The corresponding regression results can be found in Table C.4.

(equivalent to an increase of 6.4 and 7.2 percent), which falls by around half to 0.58 percentage points (3.2 percent) by the fourth election. Figure 3.8 suggest that there is a significant, even if slightly fading, geographical spillover effect.

Figure 3.9 presents the results for candidates and winners who are not incumbents. Both Panels A and B suggest that there is a positive effect two and four elections afterwards, and this may be somewhat reflective of term limits introduced in 1990, where many states enacted term limits of an even number of terms. In Panel A, there is only a significant spillover effect in the long run (four elections' time) for female candidacy. Figures 3.8 and 3.9 are consistent with the temporal spillover effects found in previous sections in that initially the positive spillover is driven by incumbents, and then eventually by new candidates.

3.7 Concluding Remarks

These results have potential implications for policy that seeks to address inequality in representation across a range of inequalities and professions. In particular, the temporal and geographical spillovers estimated suggest that a given intervention to increase female representation, whether in politics or in other professions, may have far-reaching and long-lasting impacts on future female representation. Female incumbents drive

on the spillover effect in the short run, and then new female candidates continue this temporal spillover into the long run. However, US politics and its significant incumbency advantage may not be representative of other democracies, or of other professions.

Further work could be undertaken to disaggregate the transmission mechanisms that were discussed in previous sections. One such avenue could be to evaluate 'supply' and 'demand' factors. It is unclear to what extent the spillover is driven by demand-side factors (such as changes in voter attitudes), supply-side factors (such as more women being inspired to run for office), or intermediary factors (such as political parties observing changes in voter attitudes). Understanding the relative significance of these individual mechanisms may be important in then understanding the effectiveness of specific interventions.

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Appendix A

Appendix for Chapter 1

A.1 Definitions, Sources, and Descriptive Statistics

A.1.1 Description of Characteristics

Unless otherwise stated, the characteristics listed below are coded as binary variables: taking a value of one if the candidate has that attribute or characteristic, and a value of zero otherwise.

Titles

- *Honorary Title:* The candidate has been awarded an honorary title, such as an OBE, an MBE or a knighthood. This includes the investiture of peerages where the title has not been inherited from family members.
- *Hereditary Title:* The candidate has inherited a title from a family, most commonly their father or brother. This includes titles such as Earl, Lord, Baron, and Baronet.
- *Military Title:* The candidate has been given a significant military honour. This includes both the appointment to a high-ranking military position such as Colonel or General and awards for notable military service such as the Victoria Cross.
- *Title:* The written name of the candidate on the ballot includes a title beyond 'Mr.'. This includes titles such as Sir, Dr., Lord, Viscount, and Reverend.

- *Family Hereditary Title:* A member of the candidate's family holds a title that is inherited - this does not necessarily mean that the candidate themselves ever inherits this title (for example it may be held by their uncle who passes the title down to their son, the candidate's cousin).

Education

- *Eton:* The candidate attended Eton School.
- *Public School:* The candidate attended one of the schools included in the Public Schools Act 1868. The schools (Charterhouse, Eton, Harrow, Rugby, Shrewsbury, Westminster, Winchester) are among the most elite fee-paying schools.
- *Fee Paying School:* The candidate attended a school that required fees for attendance. This would not be the case for grammar or local state schools.
- *Oxbridge:* The candidate attended at least one of the University of Cambridge and the University of Oxford.
- *University:* The candidate attended university, whether in the United Kingdom or abroad.

Occupations

- *Family Occupations:* These include the notable occupations (as mentioned in the biographies) of the candidate's family members. In most cases this will include the occupation(s) of their father, but in addition may also include the occupation(s) of other family members such as their grandparents or uncles/aunts.
- *Previous Occupations:* These include the candidate's previous occupations before running for office, and therefore may include more than one occupation. In some cases the timing of some employment is unclear so the author's judgement was used to determine whether such employment was before or after their candidacy.

Occupational Groups

- *Professionals:* These include the professions below, primarily consisting of white-collar workers or administrators.
  - *Academia:* One is defined as being part of academia if they hold an academic or teaching post, for example a Fellow or Lecturer at a university. In addition,

this may include those with no formal post but are notable for their prolific publications, for example literary writers.

  - *Civil Service:* The civil service includes most appointed public office, whether in an administrative or managerial capacity. Recurring examples include diplomats or high-ranking non-partisan Whitehall advisers.

  - *Journalism:* This includes work as a journalist or editor for a newspaper. Notably this excludes those who are newspaper proprietors, who are classified as involved in business.

  - *Law:* Working in the legal profession whether as a barrister or a solicitor.

  - *Church:* Religious occupations, the vast majority of these cases are local vicars or priests.

- *Business and Finance:* This is the collective term for those who work in business or finance.

  - *Business:* This includes any management or ownership of a company from any sector/industry.

  - *Finance:* This is defined as the work in the financial sector, such as investment banking.

- *Working Class:* This is the collective term for working-class or blue collar occupations.

  - *Engineering:* A catch-all term for more technical blue-collar work, such as foremen or technicians.

  - *Manual Labour:* For example manual work in factories.

  - *Trade Union:* Activity in supporting or running a trade union, whether locally or nationally.

- *Military:* Any military occupation at any level in the army or navy.

- *Politics:* Involvement in politics at either a local or national level.

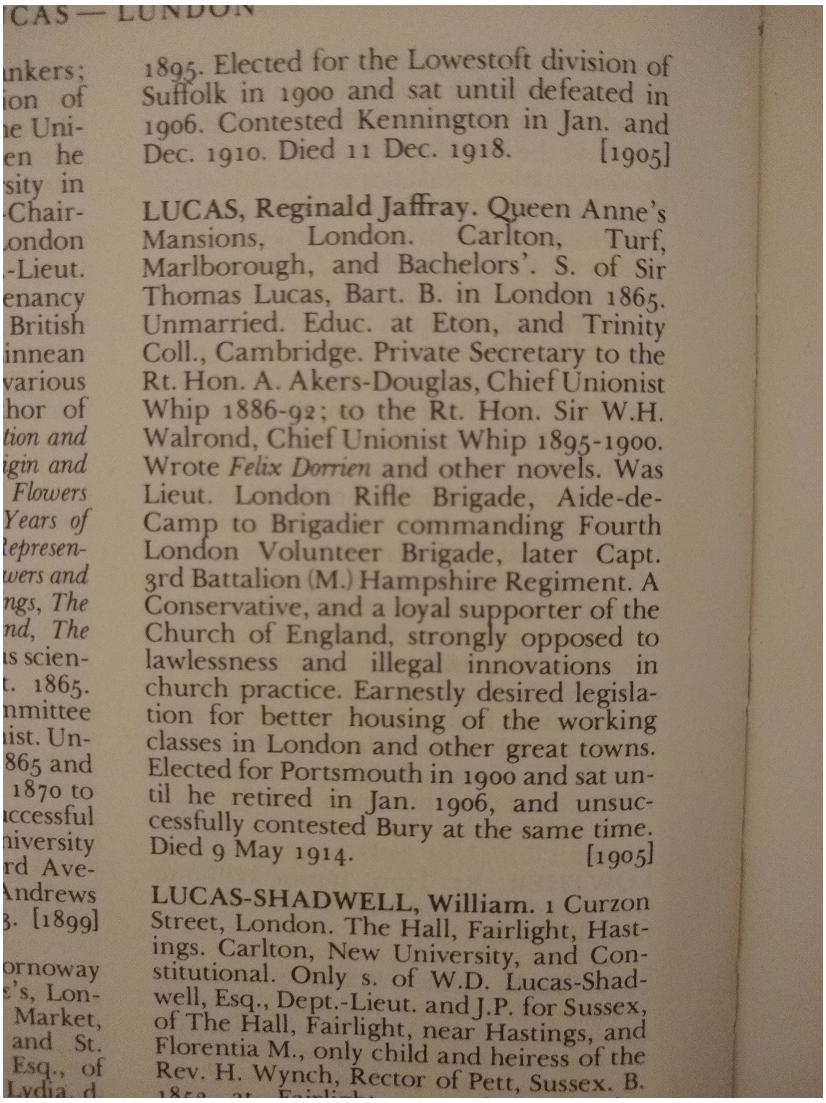
  - *Local Politics:* Examples include being on the board of a local school or committee, or local council. In many cases not this work is not necessarily affiliated with a political party.
  - *Politics/Party Politics:* This includes work in party politics, whether in the organisation of a political party or in the aid of MPs at Westminster (such as an assistant).

Social Connections

- *Number of Clubs:* The number of social clubs the candidate is a member of as listed in their biographies. Social clubs played a significant role in not only the social lives of those in the upper/upper-middle class, but also their political lives.
- *Brooks, Carlton, National Liberal, Reform:* These constitute the social clubs who are most represented among politicians. For example, the National Liberal and Reform clubs include central members of the Liberal Party, while the Brooks and Carlton those of the Conservative Party. Membership is not automatic, so inclusion in one of these is a good marker of social and political status.
- *Inner Temple, Middle Temple, Lincoln's Inn, Gray's Inn:* Membership of the London law houses. The vast majority of lawyers in the sample are a member of one of these, with the exception of practising in Scotland.
- *School Connections:* The number of connections to other candidates via the school that they attended.
- *University Connections:* The number of connections to other candidates via the university that they attended.
- *Legal Connections:* The number of connections to other candidates via the law house they practised in.
- *JP:* Whether the candidate was appointed as a Justice of the Peace. A local legal occupation, but the appointment itself indicates local political influence.

A.1.2 Data Sources

Fig. A.1 Sample Extract: Who's Who of British Members of Parliament: 1886-1918



CAS — LUNDON

1895. Elected for the Lowestoft division of Suffolk in 1900 and sat until defeated in 1906. Contested Kennington in Jan. and Dec. 1910. Died 11 Dec. 1918. [1905]

LUCAS, Reginald Jaffray. Queen Anne's Mansions, London. Carlton, Turf, Marlborough, and Bachelors'. S. of Sir Thomas Lucas, Bart. B. in London 1865. Unmarried. Educ. at Eton, and Trinity Coll., Cambridge. Private Secretary to the Rt. Hon. A. Akers-Douglas, Chief Unionist Whip 1886-92; to the Rt. Hon. Sir W.H. Walrond, Chief Unionist Whip 1895-1900. Wrote *Felix Dorrien* and other novels. Was Lieut. London Rifle Brigade, Aide-de-Camp to Brigadier commanding Fourth London Volunteer Brigade, later Capt. 3rd Battalion (M.) Hampshire Regiment. A Conservative, and a loyal supporter of the Church of England, strongly opposed to lawlessness and illegal innovations in church practice. Earnestly desired legislation for better housing of the working classes in London and other great towns. Elected for Portsmouth in 1900 and sat until he retired in Jan. 1906, and unsuccessfully contested Bury at the same time. Died 9 May 1914. [1905]

LUCAS-SHADWELL, William. 1 Curzon Street, London. The Hall, Fairlight, Hastings. Carlton, New University, and Constitutional. Only s. of W.D. Lucas-Shadwell, Esq., Dept.-Lieut. and J.P. for Sussex, of The Hall, Fairlight, near Hastings, and Florentia M., only child and heiress of the Rev. H. Wynch, Rector of Pett, Sussex. B.

Appendix for Chapter 1

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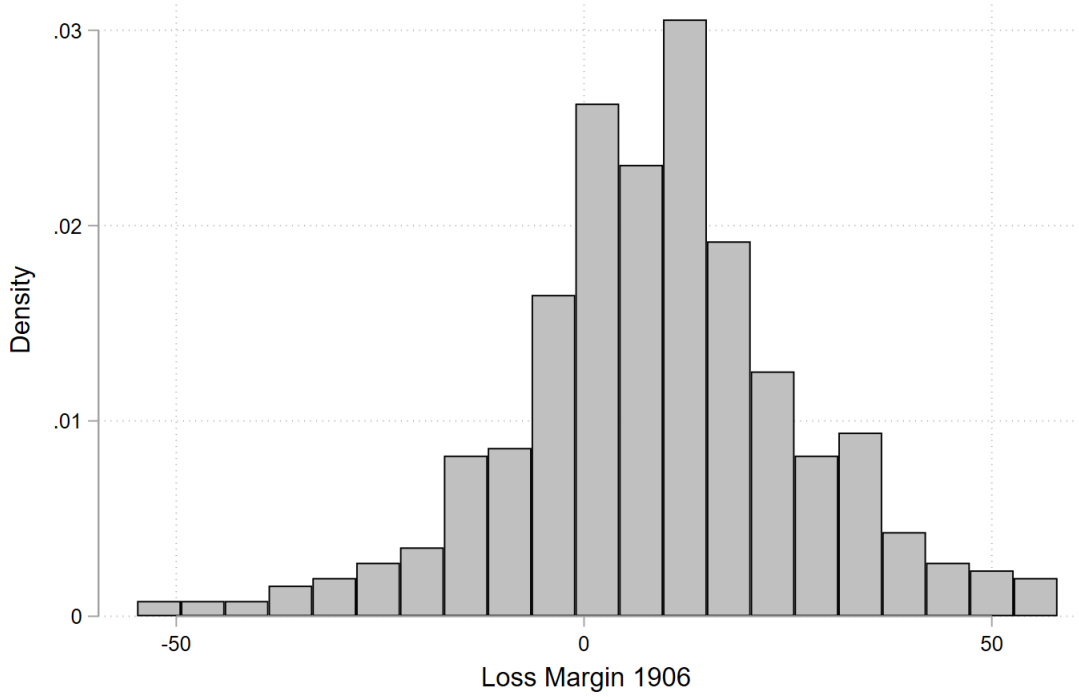
A.1.3 Election Results 1900-1910

Fig. A.2 Conservative Margin of Defeat in the 1906 UK Election



This figure illustrates the distribution of the Conservative loss margin (the proportion of the vote won by the Conservatives minus the proportion of the vote won by the most successful other party in the constituency) across constituencies in 1906.

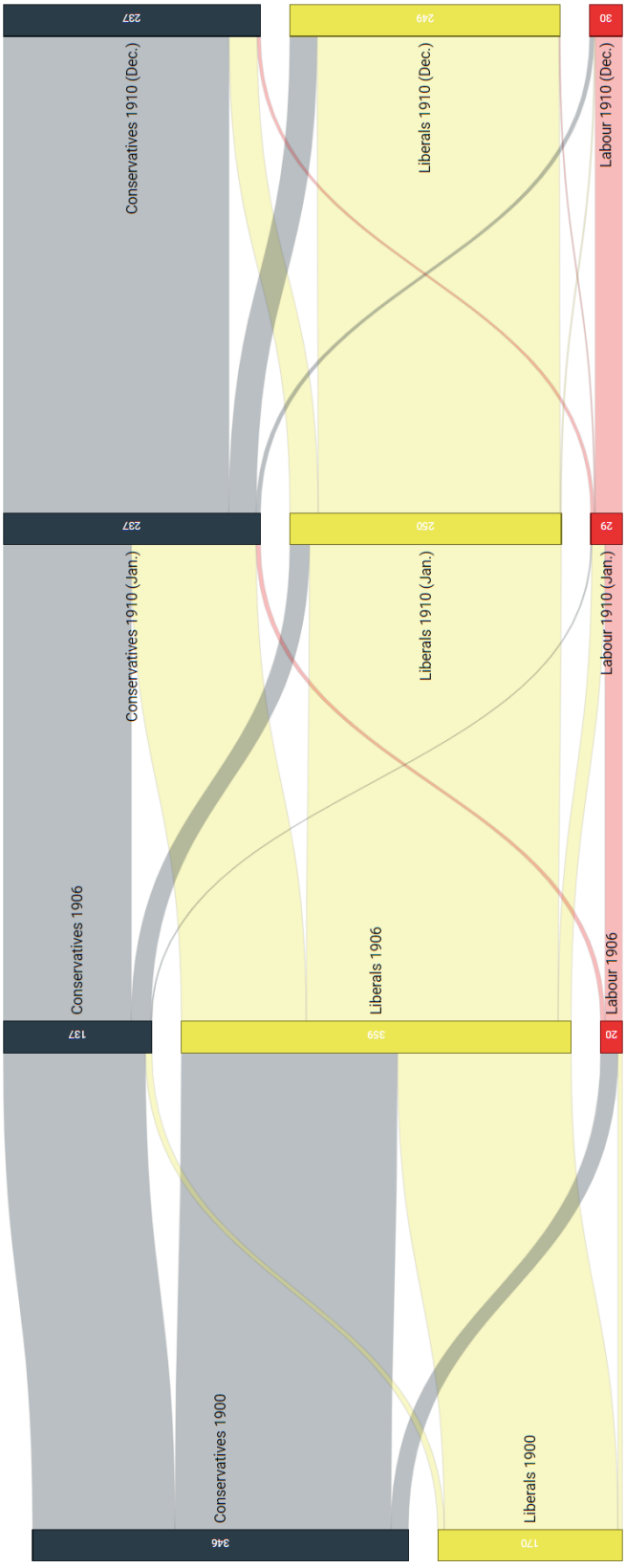


Fig. A.3 Composition of Parliament from the 1900 to 1910 (Dec.) General Elections

A.1.4 Summary Statistics

Table A.1 Summary Statistics: Education, Titles and Family Backgrounds (All Candidates)

	(1) Whole Sample mean	(2) 1906 (Jan.) mean	(3) 1910 (Dec.) mean	(4) Difference mean
Honorary Title	48.9	49.4	44.9	-9.2
Hereditary Title	20.0	21.8	16.0	-26.3
Military Title	10.4	9.8	10.0	2.3
Title	22.0	23.0	20.1	-12.9
Family Hereditary Title	25.7	26.2	23.9	-8.7
Eton	15.5	16.3	14.4	-11.4
Public School	28.0	29.3	26.0	-11.2
Fee Paying School	81.3	81.2	79.9	-1.6
Oxbridge	34.7	35.5	32.1	-9.5
University	51.4	52.4	48.7	-7.1
Professional (Family)	28.8	30.4	27.6	-9.4
Academia (Family)	9.1	9.9	9.3	-6.3
Civil Service (Family)	3.8	3.9	3.9	-2.1
Journalism (Family)	0.4	0.6	0.3	-45.8
Law (Family)	6.2	6.3	6.3	0.1
Church (Family)	12.8	13.5	11.5	-14.8
Business and Finance (Family)	17.7	17.6	16.7	-5.2
Business (Family)	14.5	14.1	13.8	-1.9
Finance (Family)	3.8	4.2	3.1	-26.0
Working Class (Family)	10.1	10.4	10.6	1.4
Engineering (Family)	2.2	2.1	2.2	3.5
Labourer (Family)	8.1	8.5	8.6	1.1
Trade Union (Family)	0.0	0.0	0.0	.
Military (Family)	14.4	14.5	14.4	-0.9
Politics and Local Politics (Family)	27.8	28.6	26.4	-7.6
Local Politics (Family)	15.1	15.4	14.9	-3.1
Politics (Family)	13.9	14.5	12.3	-14.7
Observations	3938	1038	957	905

This table reports summary statistics for a range of characteristics for all candidates in the sample, which are explained in more detail in Appendix A.1.1. Columns 2 and 3 focus on the the 1906 and December 1910 (the last election in the sample) elections, and Column 4 reports the percentage change in the proportion from 1906 to December 1910.

Table A.2 Summary Statistics: Education, Titles and Family Backgrounds (Conservative Candidates)

	(1) Whole Sample mean	(2) 1906 (Jan.) mean	(3) 1910 (Dec.) mean	(4) Difference mean
Honorary Title	50.9	54.5	45.1	-17.2
Hereditary Title	29.3	34.3	23.0	-32.7
Military Title	14.7	14.3	14.2	-0.3
Title	25.3	32.4	18.3	-43.4
Family Hereditary Title	34.0	35.0	31.2	-11.1
Eton	24.5	26.4	23.2	-12.4
Public School	40.0	42.2	37.1	-12.2
Fee Paying School	91.6	91.1	91.3	0.2
Oxbridge	41.4	41.0	39.2	-4.5
University	55.2	54.7	53.1	-3.0
Professional (Family)	28.4	29.9	27.6	-7.8
Academia (Family)	8.7	9.4	9.5	0.5
Civil Service (Family)	3.8	3.3	3.8	15.6
Journalism (Family)	0.4	0.6	0.2	-65.8
Law (Family)	6.0	6.1	6.5	6.2
Church (Family)	12.9	13.7	11.8	-14.1
Business and Finance (Family)	14.2	14.3	12.2	-14.9
Business (Family)	11.4	11.1	10.1	-8.7
Finance (Family)	3.5	3.9	2.3	-40.5
Working Class (Family)	3.3	2.7	3.6	34.3
Engineering (Family)	1.8	1.6	1.7	2.7
Labourer (Family)	1.5	1.0	1.9	84.9
Trade Union (Family)	0.0	0.0	0.0	.
Military (Family)	19.4	18.9	20.2	7.2
Politics and Local Politics (Family)	27.5	28.3	24.6	-12.9
Local Politics (Family)	15.2	15.4	14.5	-5.5
Politics (Family)	14.0	14.5	11.4	-21.9
Observations	1973	488	475	459

This table reports summary statistics for a range of characteristics for Conservative candidates in the sample, which are explained in more detail in Appendix A.1.1. Columns 2 and 3 focus on the the 1906 and December 1910 (the last election in the sample) elections, and Column 4 reports the percentage change in the proportion from 1906 to December 1910.

Table A.3 Summary Statistics: Previous Occupations and Social Connections (All Candidates)

	(1) Whole Sample mean	(2) 1906 (Jan.) mean	(3) 1910 (Dec.) mean	(4) Difference mean
Professional	55.5	56.3	52.2	-7.1
Academia	15.7	17.1	14.4	-15.9
Civil Service	32.5	33.6	27.8	-17.3
Journalism	3.5	4.1	3.6	-14.2
Law	24.7	24.0	24.2	1.1
Church	1.3	1.5	1.1	-25.4
Business and Finance	29.4	29.7	27.9	-6.0
Business	26.2	26.2	24.7	-5.9
Finance	5.5	5.6	5.5	-0.9
Working Class	8.0	8.5	8.3	-2.6
Engineer	2.4	2.2	2.5	13.2
Labourer	5.1	5.8	5.0	-13.2
Trade Union	5.5	6.4	5.9	-8.0
Military	24.4	24.8	23.7	-4.2
Politics and Local Politics	36.0	36.6	34.5	-5.8
Local Politics	34.9	35.6	33.0	-7.4
Politics	1.5	1.4	2.2	51.8
Number of Clubs	1.6	1.7	1.5	-6.5
Athenaeum Club	6.4	6.8	5.4	-20.6
Brooks Club	7.6	8.3	6.6	-20.5
Carlton Club	29.1	27.5	27.9	1.6
National Liberal Club	17.0	18.8	16.1	-14.3
Reform Club	17.1	18.8	15.2	-19.3
Inner Temple	8.5	8.6	7.6	-11.0
Middle Temple	4.3	4.0	4.5	11.0
Lincoln's Inn	3.4	3.9	2.9	-24.1
Gray's Inn'	0.8	0.3	1.1	297.7
School Connections	61.3	64.0	57.2	-10.6
University Connections	135.2	138.4	126.2	-8.8
Legal Connections	20.9	21.0	19.2	-8.6
JP	36.6	37.9	31.6	-16.8
Observations	3938	1038	957	905

This table reports summary statistics for a range of characteristics for all candidates in the sample, which are explained in more detail in Appendix A.1.1. Columns 2 and 3 focus on the the 1906 and December 1910 (the last election in the sample) elections, and Column 4 reports the percentage change in the proportion from 1906 to December 1910.

Table A.4 Summary Statistics: Previous Occupations and Social Connections (Conservative Candidates)

	(1) Whole Sample mean	(2) 1906 (Jan.) mean	(3) 1910 (Dec.) mean	(4) Difference mean
Professional	52.3	53.5	48.0	-10.3
Academia	11.1	12.7	9.5	-25.4
Civil Service	30.9	33.2	24.6	-25.8
Journalism	1.9	2.9	1.7	-41.3
Law	24.6	22.7	25.1	10.1
Church	0.9	1.0	0.4	-58.9
Business and Finance	24.8	25.2	21.5	-14.8
Business	21.4	21.3	18.3	-14.1
Finance	5.0	4.9	4.4	-10.1
Working Class	2.6	1.4	2.9	105.5
Engineer	1.7	1.0	1.5	43.8
Labourer	0.9	0.4	1.3	208.2
Trade Union	0.7	0.4	0.8	105.5
Military	35.6	36.7	34.5	-5.9
Politics and Local Politics	35.4	36.7	31.2	-15.1
Local Politics	34.1	35.2	29.7	-15.8
Politics	1.9	2.0	2.3	13.0
Number of Clubs	1.8	1.8	1.8	-4.2
Athenaeum Club	7.3	8.4	5.5	-34.8
Brooks Club	4.7	4.9	3.8	-22.9
Carlton Club	56.6	56.8	54.3	-4.3
National Liberal Club	0.7	0.8	0.8	2.7
Reform Club	1.6	1.8	0.4	-77.2
Inner Temple	10.2	9.6	9.3	-3.8
Middle Temple	3.3	3.1	4.0	30.1
Lincoln's Inn	3.3	3.9	2.7	-29.7
Gray's Inn'	0.7	0.2	1.3	516.4
School Connections	92.8	98.6	87.6	-11.2
University Connections	158.4	157.9	150.7	-4.6
Legal Connections	22.8	22.0	21.5	-2.6
JP	37.6	39.1	31.1	-20.5
Observations	1973	488	475	459

This table reports summary statistics for a range of characteristics for Conservative candidates in the sample, which are explained in more detail in Appendix A.1.1. Columns 2 and 3 focus on the the 1906 and December 1910 (the last election in the sample) elections, and Column 4 reports the percentage change in the proportion from 1906 to December 1910.

A.2 Classification: Aggregation Methods

This section illustrates the correlation between different characteristics and the group classification that the two machine learning sorting algorithms undertake. Correlations between characteristics and membership of different groups match prior expectations in the vast majority of cases.

Table A.5 Characteristics of the Elite Index (Support Vector Machine)

	Elite Index (SVM)
Academia (Family)	0.0201
	(0.0298)
Business (Family)	-0.140***
	(0.0313)
Civil Service (Family)	0.000751
	(0.0190)
Engineer (Family)	-0.0300**
	(0.0137)
Finance (Family)	-0.0119
	(0.0160)
Journalism (Family)	0.00215
	(0.00477)
Law (Family)	-0.0379
	(0.0250)
Local Politics (Family)	0.0307
	(0.0370)
Military (Family)	0.0676
	(0.0413)
Church (Family)	0.0370
	(0.0339)
Academia	0.000468
	(0.0298)
Business	-0.386***
	(0.0382)
Civil Service	0.0588
	(0.0444)
Engineer	-0.0525***
	(0.0133)
Finance	-0.0135
	(0.0225)
Journalism	0.0110
	(0.0142)
Labourer	-0.0690***
	(0.0103)
Law	0.0921**
	(0.0448)
Local Politics	-0.130***
	(0.0466)
Military	0.438***
	(0.0459)

	Elite Index (SVM)
Politics	0.00388
	(0.0160)
Church	0.00209
	(0.00584)
Trade Union	-0.0489***
	(0.00874)
Oxbridge	0.692***
	(0.0428)
University	0.569***
	(0.0436)
Eton	0.540***
	(0.0396)
Public School	0.844***
	(0.0393)
Published Author	0.000672*
	(0.000394)
Athenaeum Club	0.0765***
	(0.0249)
Brooks Club	0.0909***
	(0.0206)
Carlton Club	0.284***
	(0.0466)
National Liberal Club	-0.0216**
	(0.00887)
Reform Club	-0.00628
	(0.00824)
Number of Clubs	0.0120***
	(0.00129)
School Connections	2.014***
	(0.113)
University Connections	2.645***
	(0.157)
Legal Connections	0.308***
	(0.0537)
Honorary Title	0.00891
	(0.0490)
Hereditary Title	0.349***
	(0.0407)
Military Title	0.168***
	(0.0348)
JP	0.0893**
	(0.0451)

This table illustrates the characteristics of the elite index, reporting the coefficient results of simply regressing the characteristic variable on the elite index created by the Support Vector Machine. Standard errors are reported in parentheses and are clustered at the constituency level. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

Table A.6 Characteristics of the Elite Index (Latent Dirichlet Allocation)

	Elite Index (LDA)
Academia (Family)	-0.169***
	(0.0302)
Business (Family)	-0.231***
	(0.0317)
Civil Service (Family)	-0.0105
	(0.0196)
Engineer (Family)	-0.0583***
	(0.0141)
Finance (Family)	-0.0262
	(0.0164)
Journalism (Family)	-0.00917*
	(0.00490)
Law (Family)	-0.160***
	(0.0252)
Local Politics (Family)	-0.0354
	(0.0381)
Military (Family)	0.222***
	(0.0420)
Church (Family)	-0.101***
	(0.0348)
Academia	-0.220***
	(0.0298)
Business	-0.364***
	(0.0398)
Civil Service	0.0256
	(0.0458)
Engineer	-0.0594***
	(0.0136)
Finance	0.00702
	(0.0232)
Journalism	-0.0333**
	(0.0146)
Labourer	-0.0451***
	(0.0108)
Law	-0.561***
	(0.0421)
Local Politics	-0.124***
	(0.0480)
Military	0.817***
	(0.0411)

	Elite Index (LDA)
Politics	0.0286*
	(0.0164)
Church	-0.00438
	(0.00601)
Trade Union	-0.0330***
	(0.00910)
Oxbridge	0.297***
	(0.0494)
University	0.0654
	(0.0492)
Eton	0.727***
	(0.0375)
Public School	1.032***
	(0.0357)
Published Author	-0.00124***
	(0.000404)
Athenaeum Club	-0.0910***
	(0.0256)
Brooks Club	0.110***
	(0.0211)
Carlton Club	0.260***
	(0.0483)
National Liberal Club	-0.0263***
	(0.00912)
Reform Club	-0.0256***
	(0.00845)
Number of Clubs	0.00841***
	(0.00136)
School Connections	2.589***
	(0.104)
University Connections	1.020***
	(0.184)
Legal Connections	-0.354***
	(0.0550)
Honorary Title	-0.178***
	(0.0501)
Hereditary Title	0.486***
	(0.0403)
Military Title	0.335***
	(0.0345)
JP	0.0750
	(0.0466)

This table illustrates the characteristics of the political elite group as defined by Latent Dirichlet Allocation, reporting the coefficient results of simply regressing the characteristic variable on the probability that the Latent Dirichlet Allocation defines the candidate as being part of the political elite. Standard errors are reported in parentheses and are clustered at the constituency level. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

Table A.7 Characteristics of the Working-Class/Political Outsider Group (Latent Dirichlet Allocation)

	Working (LDA)
Academia (Family)	-0.00504
	(0.0425)
Business (Family)	0.494***
	(0.0419)
Civil Service (Family)	-0.0457*
	(0.0270)
Engineer (Family)	0.101***
	(0.0193)
Finance (Family)	0.0801***
	(0.0226)
Journalism (Family)	0.0119*
	(0.00678)
Law (Family)	-0.108***
	(0.0354)
Local Politics (Family)	0.00505
	(0.0527)
Military (Family)	-0.170***
	(0.0587)
Church (Family)	-0.0408
	(0.0483)
Academia	-0.0445
	(0.0425)
Business	0.929***
	(0.0480)
Civil Service	0.0258
	(0.0633)
Engineer	0.149***
	(0.0184)
Finance	0.110***
	(0.0318)
Journalism	0.0514**
	(0.0201)
Labourer	0.118***
	(0.0146)
Law	-0.489***
	(0.0617)
Local Politics	0.434***
	(0.0649)
Military	-0.517***
	(0.0664)
Politics	-0.0232
	(0.0227)
Church	-0.00876
	(0.00831)
Trade Union	0.0973***
	(0.0122)
Oxbridge	-0.986***
	(0.0610)
University	-0.826***
	(0.0619)
Eton	-0.634***
	(0.0583)
Public School	-1.004***
	(0.0604)
Published Author	-0.00142**
	(0.000560)
Athenaeum Club	-0.161***
	(0.0352)
Brooks Club	-0.105***
	(0.0295)
Carlton Club	-0.229***
	(0.0674)
National Liberal Club	0.0531***
	(0.0125)
Reform Club	0.0122
	(0.0117)
Number of Clubs	-0.0104***
	(0.00189)
School Connections	-2.363***
	(0.171)
University Connections	-3.697***
	(0.225)
Legal Connections	-0.579***
	(0.0753)
Honorary Title	-0.00363
	(0.0698)
Hereditary Title	-0.325***
	(0.0593)
Military Title	-0.218***
	(0.0497)
JP	-0.0497
	(0.0644)

This table illustrates the characteristics of the working-class/political outsiders group as defined by Latent Dirichlet Allocation, reporting the coefficient results of simply regressing the characteristic variable on the probability that the Latent Dirichlet Allocation defines the candidate as being part of the working class/political outsiders. Standard errors are reported in parentheses and are clustered at the constituency level. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

A.3 SVM/LDA Variables: Regression Tables and Figures

A.3.1 Falsification Test

Table A.8 Comparing Political Parties

	(1) Elite (SVM)	(2) Elite (LDA)	(3) Middle (LDA)	(4) Working (LDA)
Other Parties × 1906 Loss Margin	0.035	0.005	-0.015	0.016
	(0.081)	(0.063)	(0.063)	(0.059)
Conservatives × 1906 Loss Margin	-0.271**	-0.216**	0.057	0.155*
	(0.121)	(0.094)	(0.094)	(0.087)
Adjusted R^2	0.303	0.376	0.237	0.413
N	1038	1040	1040	1040

This table reports the estimates of the effects of the 1906 loss margin in a constituency on the type of candidate select in 1910, across different political parties (not just the Conservatives). The dependent variable in Column 1 is the probability that the candidate is a member of the political elite as defined by the Support Vector Machine. In Columns 2, 3, and 4, the dependent variable is the probability that the candidate is a member of the political elite, middle class, and working class, respectively, as defined by the Latent Dirichlet Allocation. The explanatory variables reported are the 1906 loss margin interacted with whether the candidate is from Other Parties (besides the Conservatives) and another interaction with whether candidate is from the Conservatives. The 1906 loss margin is the Conservative loss to the winning party, as a percentage of total votes cast in the constituency (negative if the Conservatives won). Standard errors are reported in parentheses and are clustered at the constituency level. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

A.3.2 Don't Lose, Don't Learn?

Table A.9 Incumbents and Losing Candidates

	(1) Elite (SVM)	(2) Elite (LDA)	(3) Middle (LDA)	(4) Working (LDA)
1906 Loss Margin	0.188	0.140	-0.071	-0.087
	(0.267)	(0.239)	(0.220)	(0.174)
1906 Conservative Defeat × 1906 Loss Margin	-0.649**	-0.577**	0.213	0.400**
	(0.298)	(0.268)	(0.247)	(0.194)
1906 Conservative Defeat	-0.639	1.911	-1.282	-0.886
	(5.636)	(5.031)	(4.640)	(3.667)
Adjusted R^2	0.096	0.212	0.106	0.168
N	468	468	468	468

This table reports the estimates of the effects of the 1906 loss margin in a constituency on the type of candidate the Conservatives select in 1910, for different outcomes in 1906. The dependent variable in Column 1 is the probability that the candidate is a member of the political elite as defined by the Support Vector Machine. In Columns 2, 3, and 4, the dependent variable is the probability that the candidate is a member of the political elite, middle class, and working class, respectively, as defined by the Latent Dirichlet Allocation. The explanatory variables reported are the 1906 loss margin and the 1906 loss margin interacted with whether the Conservatives lost in 1906. The 1906 loss margin is the Conservative loss to the winning party, as a percentage of total votes cast in the constituency (negative if the Conservatives won). The lagged dependent variables are the values of the dependent variables in 1906. The 1900 loss margin and lagged dependent variable are also included, as well as a dummy variable that takes value of one if the Conservatives lost in that constituency in 1906. Standard errors are reported in parentheses and are clustered at the constituency level. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

A.3.3 Conservative Strongholds

Table A.10 Conservative Strongholds

	(1) Elite (SVM)	(2) Elite (LDA)	(3) Middle (LDA)	(4) Working (LDA)
1906 Loss Margin	-0.209	-0.247**	0.178*	0.060
	(0.131)	(0.117)	(0.106)	(0.085)
Conservative Stronghold × 1906 Loss Margin	-0.174	0.039	-0.338**	0.331**
	(0.199)	(0.177)	(0.160)	(0.129)
Adjusted R^2	0.087	0.205	0.123	0.171
N	468	468	468	468

This table reports the estimates of the effects of the 1906 loss margin in a constituency on the type of candidate the Conservatives select in 1910, for different types of constituencies. The dependent variable in Column 1 is the probability that the candidate is a member of the political elite as defined by the Support Vector Machine. In Columns 2, 3, and 4, the dependent variable is the probability that the candidate is a member of the political elite, middle class, and working class, respectively, as defined by the Latent Dirichlet Allocation. The explanatory variables reported are the 1906 loss margin interacted with whether the constituency is a Conservative stronghold and the 1906 loss margin interacted with whether the constituency is one of the other constituencies. The 1906 loss margin is the Conservative loss to the winning party, as a percentage of total votes cast in the constituency (negative if the Conservatives won). The lagged dependent variables are the values of the dependent variables in 1906. The 1900 loss margin and lagged dependent variable are also included. Standard errors are reported in parentheses and are clustered at the constituency level. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

A.3.4 Working-Class Constituencies

Table A.11 Working Class Constituencies

	(1) Elite (SVM)	(2) Elite (LDA)	(3) Middle (LDA)	(4) Working (LDA)
1906 Loss Margin	-0.074	-0.162	0.094	0.082
	(0.123)	(0.111)	(0.102)	(0.080)
Working Class × 1906 Loss Margin	-0.478***	-0.205	-0.056	0.245**
	(0.165)	(0.149)	(0.137)	(0.108)
Adjusted R^2	0.103	0.206	0.106	0.169
N	468	468	468	468

This table reports the estimates of the effects of the 1906 loss margin in a constituency on the type of candidate the Conservatives select in 1910, for different types of constituencies. The dependent variable in Column 1 is the probability that the candidate is a member of the political elite as defined by the Support Vector Machine. In Columns 2, 3, and 4, the dependent variable is the probability that the candidate is a member of the political elite, middle class, and working class, respectively, as defined by the Latent Dirichlet Allocation. The explanatory variables reported are the 1906 loss margin interacted with whether the constituency is a defined as a working-class constituency and the 1906 loss margin interacted with whether the constituency is one of the other constituencies. The 1906 loss margin is the Conservative loss to the winning party, as a percentage of total votes cast in the constituency (negative if the Conservatives won). The lagged dependent variables are the values of the dependent variables in 1906. The 1900 loss margin and lagged dependent variable are also included. Standard errors are reported in parentheses and are clustered at the constituency level. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

A.3.5 A Winning Strategy? Implications for the 1910 Elections

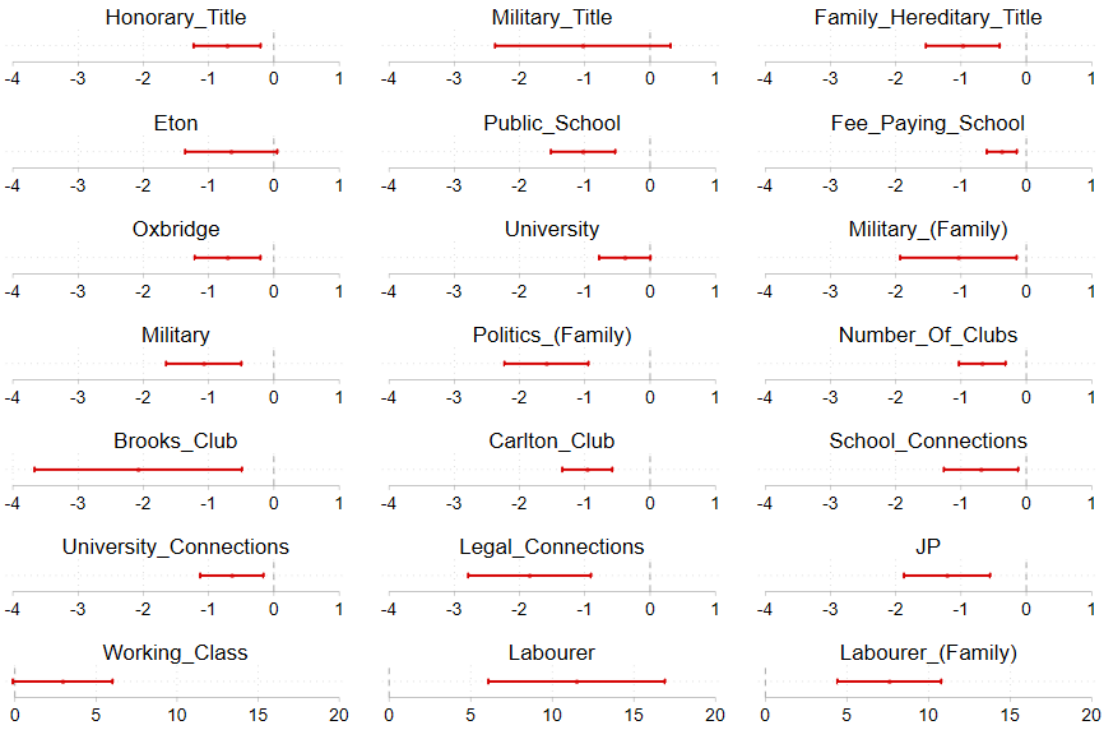
Table A.12 Baseline Results

	(1) Win Margin 1910	(2) Win Margin 1910
Elite (SVM) × Upper-Class Constituency	4.923***	
	(1.120)	
Elite (SVM) × Middle-Class Constituency	-5.554***	
	(0.961)	
Elite (SVM) × Working-Class Constituency	-6.902***	
	(1.025)	
Elite (LDA) × Upper-Class Constituency		5.340***
		(1.294)
Elite (LDA) × Middle-Class Constituency		-6.672***
		(1.264)
Elite (LDA) × Working-Class Constituency		-7.611***
		(1.341)
Adjusted R^2	0.391	0.377
N	348	348

This table reports the effect of increasing the probability that a candidate is a member of the political elite by one standard deviation on the Conservative win margin, as outlined in Section 1.9. The signs are different to those of Figure 1.8, as Figure 1.8 illustrates the effect of decreasing the probability that a candidate is a member of the political elite, rather than increasing.

A.4 All Characteristics: Regression Tables and Figures

Fig. A.4 Baseline Results



This figure illustrates baseline coefficient estimates (and 95 per cent confidence intervals) of the 1906 loss margin on whether the Conservative candidate in 1910 has a given characteristic.

A.5 Results Excluding Controls

This section reproduces the results from the main paper excluding controls: which are the candidate characteristics from 1906 and the loss margin from 1900.

Table A.13 Baseline Results

	(1) Elite (SVM)	(2) Elite (LDA)	(3) Middle (LDA)	(4) Working (LDA)
1906 Loss Margin	-0.101*	-0.229***	0.179***	0.050
	(0.060)	(0.058)	(0.049)	(0.042)
Adjusted R^2	0.002	0.017	0.015	0.000
N	821	821	821	821

This table reports the estimates of the effects of the 1906 loss margin in a constituency on the type of candidate the Conservatives select in 1910. The dependent variable in Column 1 is the probability that the candidate is a member of the political elite as defined by the Support Vector Machine. In Columns 2, 3, and 4, the dependent variable is the probability that the candidate is a member of the political elite, middle class, and working class, respectively, as defined by the Latent Dirichlet Allocation. The 1906 loss margins are the Conservative losses to the winning party, as a percentage of total votes cast in the constituency (negative if the Conservatives won). Standard errors are reported in parentheses and are clustered at the constituency level. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

Table A.14 Falsification Test

	(1) Elite (SVM)	(2) Elite (LDA)	(3) Middle (LDA)	(4) Working (LDA)
Other Parties × 1906 Loss Margin	0.010	-0.063	0.099*	-0.036
	(0.069)	(0.054)	(0.052)	(0.053)
Conservatives × 1906 Loss Margin	-0.111	-0.166**	0.080	0.086
	(0.096)	(0.076)	(0.073)	(0.074)
Adjusted R^2	0.087	0.183	0.015	0.131
N	1623	1624	1624	1624

This table reports the estimates of the effects of the 1906 loss margin in a constituency on the type of candidate select in 1910, across different political parties (not just the Conservatives). The dependent variable in Column 1 is the probability that the candidate is a member of the political elite as defined by the Support Vector Machine. In Columns 2, 3, and 4, the dependent variable is the probability that the candidate is a member of the political elite, middle class, and working class, respectively, as defined by the Latent Dirichlet Allocation. The explanatory variables reported are the 1906 loss margin interacted with whether the candidate is from Other Parties (besides the Conservatives) and another interaction with whether candidate is from the Conservatives. The 1906 loss margin is the Conservative loss to the winning party, as a percentage of total votes cast in the constituency (negative if the Conservatives won). Standard errors are reported in parentheses and are clustered at the constituency level. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

Table A.15 Don't Lose, Don't Learn?

	(1) Elite (SVM)	(2) Elite (LDA)	(3) Middle (LDA)	(4) Working (LDA)
1906 Loss Margin	0.378***	0.340**	0.003	-0.343***
	(0.140)	(0.134)	(0.114)	(0.098)
1906 Conservative Defeat × 1906 Loss Margin	-0.723***	-0.905***	0.293**	0.612***
	(0.173)	(0.165)	(0.140)	(0.121)
1906 Conservative Defeat	-2.956	-1.747	0.081	1.666
	(3.651)	(3.482)	(2.964)	(2.554)
Adjusted R^2	0.021	0.050	0.018	0.029
N	821	821	821	821

This table reports the estimates of the effects of the 1906 loss margin in a constituency on the type of candidate the Conservatives select in 1910, for different outcomes in 1906. The dependent variable in Column 1 is the probability that the candidate is a member of the political elite as defined by the Support Vector Machine. In Columns 2, 3, and 4, the dependent variable is the probability that the candidate is a member of the political elite, middle class, and working class, respectively, as defined by the Latent Dirichlet Allocation. The explanatory variables reported are the 1906 loss margin and the 1906 loss margin interacted with whether the Conservatives lost in 1906. The 1906 loss margin is the Conservative loss to the winning party, as a percentage of total votes cast in the constituency (negative if the Conservatives won). A dummy variable that takes value of one if the Conservatives lost in that constituency in 1906 is included. Standard errors are reported in parentheses and are clustered at the constituency level. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

Table A.16 Conservative Strongholds

	(1) Elite (SVM)	(2) Elite (LDA)	(3) Middle (LDA)	(4) Working (LDA)
1906 Loss Margin	-0.049	-0.235**	0.263***	-0.028
	(0.101)	(0.096)	(0.081)	(0.071)
Conservative Stronghold × 1906 Loss Margin	-0.013	0.131	-0.250**	0.119
	(0.133)	(0.127)	(0.106)	(0.093)
Adjusted R^2	0.003	0.025	0.029	0.000
N	821	821	821	821

This table reports the estimates of the effects of the 1906 loss margin in a constituency on the type of candidate the Conservatives select in 1910, for different types of constituencies. The dependent variable in Column 1 is the probability that the candidate is a member of the political elite as defined by the Support Vector Machine. In Columns 2, 3, and 4, the dependent variable is the probability that the candidate is a member of the political elite, middle class, and working class, respectively, as defined by the Latent Dirichlet Allocation. The explanatory variables reported are the 1906 loss margin interacted with whether the constituency is a Conservative stronghold and the 1906 loss margin interacted with whether the constituency is one of the other constituencies. The 1906 loss margin is the Conservative loss to the winning party, as a percentage of total votes cast in the constituency (negative if the Conservatives won). Standard errors are reported in parentheses and are clustered at the constituency level. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

Table A.17 Working-Class Constituencies

	(1) Elite (SVM)	(2) Elite (LDA)	(3) Middle (LDA)	(4) Working (LDA)
1906 Loss Margin	-0.085	-0.219***	0.214***	0.005
	(0.076)	(0.073)	(0.061)	(0.053)
Working Class × 1906 Loss Margin	-0.042	-0.025	-0.092	0.117
	(0.119)	(0.115)	(0.096)	(0.084)
Adjusted R^2	0.001	0.016	0.015	0.002
N	821	821	821	821

This table reports the estimates of the effects of the 1906 loss margin in a constituency on the type of candidate the Conservatives select in 1910, for different types of constituencies. The dependent variable in Column 1 is the probability that the candidate is a member of the political elite as defined by the Support Vector Machine. In Columns 2, 3, and 4, the dependent variable is the probability that the candidate is a member of the political elite, middle class, and working class, respectively, as defined by the Latent Dirichlet Allocation. The explanatory variables reported are the 1906 loss margin interacted with whether the constituency is a defined as a working-class constituency and the 1906 loss margin interacted with whether the constituency is one of the other constituencies. The 1906 loss margin is the Conservative loss to the winning party, as a percentage of total votes cast in the constituency (negative if the Conservatives won). Standard errors are reported in parentheses and are clustered at the constituency level. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

A.6 Classification Robustness

A.6.1 Support Vector Machine: Different Initial Labels

This section reproduces the Support Vector Machine results in the main paper, but illustrates the robustness of the findings by altering the initial labelling. I instead initially label the unambiguously elite as those whose families have hereditary titles and also attend a public school, while the unambiguous outsiders or working are those whose families are labourers. These results are reported in Table A.18 below.

Table A.18 Baseline Results: Different Initial Labels (SVM)

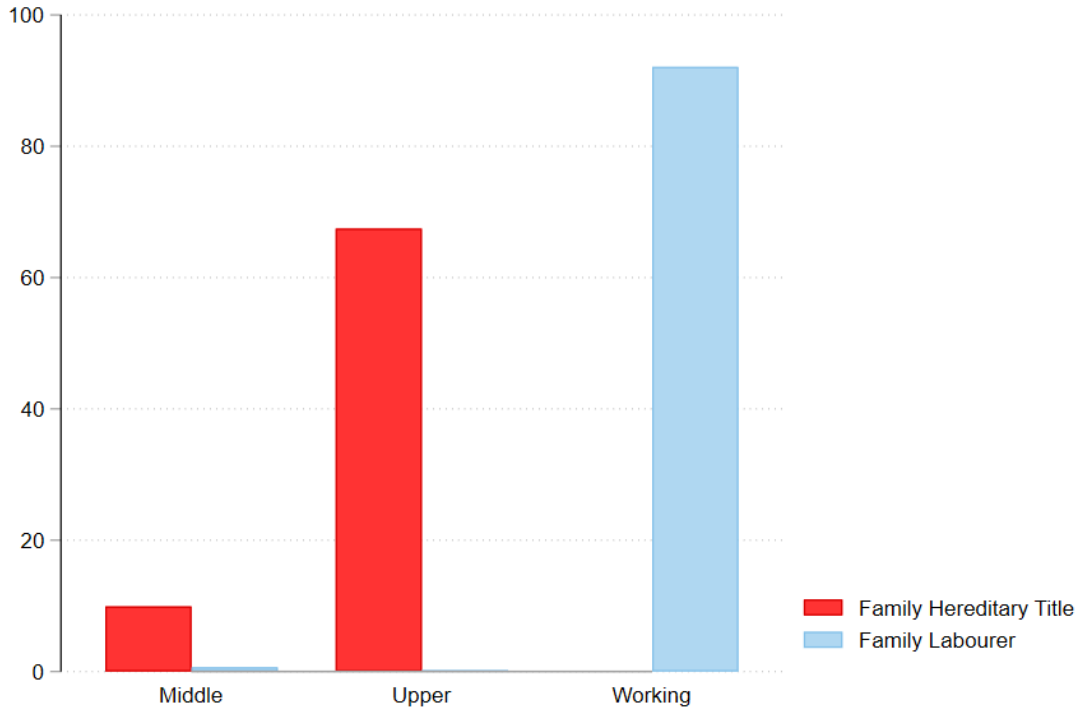
	(1)	(2)	(3)	(4)	(5)
1906 Loss Margin	-0.401**	0.101	0.383	-0.272	0.00825
	(0.198)	(0.164)	(0.539)	(0.236)	(0.346)
Conservative × 1906 Loss Margin		-0.508*			
		(0.282)			
Conservative Defeat × 1906 Loss Margin			-1.112*		
			(0.602)		
Conservative Stronghold × 1906 Loss Margin				-0.343	
				(0.345)	
Working Class × 1906 Loss Margin					-0.832**
					(0.418)
Adjusted R^2	0.103	0.294	0.107	0.103	0.152
N	468	1038	468	468	238

This table reproduces results from the main paper, with the probabilities of the candidate being part of the political elite defined by a different Support Vector Machine, where the new initial labelling is defined in the above explanation.

A.6.2 K-Means Clustering

Another potential method of clustering is k-means clustering, which has been used for classification in the economics literature, for example by Crone (2005). For a given number of groups (such as three), k-means clustering minimises the within-cluster variances in the space of candidate characteristics. The three groups that are summarised in Figure A.5, which illustrates a clear political elite, working class, and middle class.

Fig. A.5 Characteristics of Candidates in Different K-Mean Clusters



I replicate the results in the main paper, replacing the Latent Dirichlet Allocation variables for the political elite and the working class with indicators from the k-means clustering method, and they are reported in Tables A.19 and A.20.

Table A.19 Baseline Results: K-Means Clustering (Upper Class)

	(1)	(2)	(3)	(4)	(5)
1906 Loss Margin	-1.121***	-0.454	-0.414	-0.926***	-0.301
	(0.231)	(0.325)	(0.637)	(0.256)	(0.440)
Conservative × 1906 Loss Margin		-0.676			
		(0.510)			
Conservative Defeat × 1906 Loss Margin			-1.100		
			(0.718)		
Conservative Stronghold × 1906 Loss Margin				-0.760*	
				(0.430)	
Working Class × 1906 Loss Margin					-1.099**
					(0.498)
Adjusted R^2	0.168	0.230	0.171	0.171	0.172
N	641	1242	641	641	317

This table reproduces the key results from the main paper, but defines the dependent variable as the probability that the candidate is a member of the political elite/upper class as defined by the K-means clustering method.

Table A.20 Baseline Results: K-Means Clustering (Working Class)

	(1)	(2)	(3)	(4)	(5)
1906 Loss Margin	7.552***	-1.701	-0.991	8.075***	2.618
	(1.566)	(1.045)	(4.286)	(1.738)	(3.960)
Conservative × 1906 Loss Margin		7.059***			
		(1.641)			
Conservative Defeat × 1906 Loss Margin			12.45***		
			(4.815)		
Conservative Stronghold × 1906 Loss Margin				-2.032	
				(2.921)	
Working Class × 1906 Loss Margin					10.72**
					(4.472)
Adjusted R^2	0.0308	0.0286	0.0412	0.0300	0.0593
N	641	1253	641	641	317

This table reproduces the key results from the main paper, but defines the dependent variable as the probability that the candidate is a member of the working class as defined by the K-means clustering method.

A.6.3 Latent Dirichlet Allocation: Different Number of Groups

I reproduce the results in the main paper using the Latent Dirichlet Allocation for different number of defined groups. The main paper focuses on three groups, and the following reports the results for two, four, five, and six groups. While the results regarding the political elite are not particularly robust, the results regarding the increasing in working-class representation are consistently positive.

Table A.21 Baseline Results: (LDA) 2 Clusters - Political Elite

	(1)	(2)	(3)	(4)	(5)
1906 Loss Margin	-0.337***	0.220***	-0.0296	-0.189	-0.285*
	(0.0879)	(0.0632)	(0.238)	(0.124)	(0.159)
Conservative × 1906 Loss Margin		-0.286***			
		(0.106)			
Conservative Defeat × 1906 Loss Margin			-0.499*		
			(0.267)		
Conservative Stronghold × 1906 Loss Margin				-0.245*	
				(0.146)	
Working Class × 1906 Loss Margin					-0.159
					(0.191)
Adjusted R^2	0.209	0.394	0.216	0.212	0.156
N	468	1040	468	468	238

This table reproduces the key results from the main paper, but defines the dependent variable as the probability that the candidate is a member of the political elite/upper class when clustering for two groups using the LDA.

Table A.22 Baseline Results: (LDA) 4 Clusters - Political Elite

	(1)	(2)	(3)	(4)	(5)
1906 Loss Margin	-0.221***	0.121**	0.284	-0.251**	-0.0663
	(0.0821)	(0.0513)	(0.222)	(0.116)	(0.148)
Conservative × 1906 Loss Margin		-0.179**			
		(0.0867)			
Conservative Defeat × 1906 Loss Margin			-0.738***		
			(0.249)		
Conservative Stronghold × 1906 Loss Margin				0.0494	
				(0.137)	
Working Class × 1906 Loss Margin					-0.272
					(0.180)
Adjusted R^2	0.253	0.376	0.268	0.251	0.158
N	468	1040	468	468	238

This table reproduces the key results from the main paper, but defines the dependent variable as the probability that the candidate is a member of the political elite/upper class when clustering for four groups using the LDA.

Table A.23 Baseline Results: (LDA) 4 Clusters - Working Class

	(1)	(2)	(3)	(4)	(5)
1906 Loss Margin	0.0995***	-0.148***	-0.0117	-0.0228	-0.00711
	(0.0377)	(0.0400)	(0.102)	(0.0527)	(0.0754)
Conservative × 1906 Loss Margin		0.0818			
		(0.0677)			
Conservative Defeat × 1906 Loss Margin			0.219*		
			(0.114)		
Conservative Stronghold × 1906 Loss Margin				0.204***	
				(0.0620)	
Working Class × 1906 Loss Margin					0.293***
					(0.0895)
Adjusted R^2	0.0487	0.472	0.0669	0.0684	0.0817
N	468	1040	468	468	238

This table reproduces the key results from the main paper, but defines the dependent variable as the probability that the candidate is a member of the working class when clustering for four groups using the LDA.

Table A.24 Baseline Results: (LDA) 5 Clusters - Political Elite

	(1)	(2)	(3)	(4)	(5)
1906 Loss Margin	-0.175**	0.0865*	0.267	-0.121	-0.0314
	(0.0777)	(0.0477)	(0.211)	(0.110)	(0.138)
Conservative × 1906 Loss Margin		-0.128			
		(0.0812)			
Conservative Defeat × 1906 Loss Margin			-0.616***		
			(0.237)		
Conservative Stronghold × 1906 Loss Margin				-0.0887	
				(0.130)	
Working Class × 1906 Loss Margin					-0.302*
					(0.168)
Adjusted R^2	0.216	0.315	0.225	0.215	0.135
N	468	1040	468	468	238

This table reproduces the key results from the main paper, but defines the dependent variable as the probability that the candidate is a member of the political elite/upper class when clustering for five groups using the LDA.

Table A.25 Baseline Results: (LDA) 5 Clusters - Working Class

	(1)	(2)	(3)	(4)	(5)
1906 Loss Margin	0.103***	-0.120***	0.0178	-0.0142	0.0152
	(0.0308)	(0.0333)	(0.0832)	(0.0429)	(0.0641)
Conservative × 1906 Loss Margin		0.0987*			
		(0.0567)			
Conservative Defeat × 1906 Loss Margin			0.175*		
			(0.0930)		
Conservative Stronghold × 1906 Loss Margin				0.195***	
				(0.0505)	
Working Class × 1906 Loss Margin					0.245***
					(0.0765)
Adjusted R^2	0.0510	0.486	0.0698	0.0787	0.0913
N	468	1040	468	468	238

This table reproduces the key results from the main paper, but defines the dependent variable as the probability that the candidate is a member of the working class when clustering for five groups using the LDA.

Table A.26 Baseline Results: (LDA) 6 Clusters - Political Elite

	(1)	(2)	(3)	(4)	(5)
1906 Loss Margin	-0.166**	0.0745*	0.222	-0.0809	-0.0272
	(0.0723)	(0.0443)	(0.197)	(0.102)	(0.128)
Conservative × 1906 Loss Margin		-0.129*			
		(0.0755)			
Conservative Defeat × 1906 Loss Margin			-0.534**		
			(0.220)		
Conservative Stronghold × 1906 Loss Margin				-0.141	
				(0.120)	
Working Class × 1906 Loss Margin					-0.281*
					(0.155)
Adjusted R^2	0.263	0.343	0.270	0.263	0.190
N	468	1040	468	468	238

This table reproduces the key results from the main paper, but defines the dependent variable as the probability that the candidate is a member of the political elite/upper class when clustering for six groups using the LDA.

Table A.27 Baseline Results: (LDA) 6 Clusters - Working Class

	(1)	(2)	(3)	(4)	(5)
1906 Loss Margin	0.143***	-0.0646***	0.0201	0.0402	0.0694
	(0.0263)	(0.0231)	(0.0713)	(0.0367)	(0.0501)
Conservative × 1906 Loss Margin		0.154***			
		(0.0396)			
Conservative Defeat × 1906 Loss Margin			0.188**		
			(0.0797)		
Conservative Stronghold × 1906 Loss Margin				0.171***	
				(0.0432)	
Working Class × 1906 Loss Margin					0.184***
					(0.0605)
Adjusted R^2	0.0995	0.412	0.112	0.127	0.148
N	468	1040	468	468	238

This table reproduces the key results from the main paper, but defines the dependent variable as the probability that the candidate is a member of the working class when clustering for six groups using the LDA.

A.6.4 Missing Data Assumptions

Missing Biographical Data

This section provides robustness checks concerning missing biographical data on certain candidates. For example, those with missing biographical data may be more likely to come from working-class backgrounds, as they are less likely to appear in the Oxford Dictionary of National Biography if their sole activity in public life was to run for a seat in Parliament. Although it is not immediately clear in what direction the bias due to the missing data goes, I make a range of assumptions about the type of candidates these missing candidates may be, and find that the results are similar to those in the main paper.

As shown in Table A.28, there are a non-negligible percentage of observations where there is incomplete biographical data. Table A.29 replicate the baseline results using the SVM estimates across different assumptions about those with incomplete biographical data, while Tables A.30, A.31, A.32, and A.33 do so for the LDA estimates.

Table A.28 Missing Biographical Data (Percentage of Observations)

	Conservatives	Independents	Labour	Liberals	Average
1900 Election	6.5	66.7	10.0	11.7	8.9
1906 Election	10.9	25	8.2	6.3	8.8
January 1910 Election	14.5	10	7.1	11.0	12.5
December 1910 Election	14.1	40	2.2	11.6	12.5
Average	11.5	26.7	6.3	10	10.7

This table reports the percentage of candidates from each party-election where there is incomplete biographical information.

Table A.29 Missing Biographical Data: SVM Baseline Results

	(1) Missing=0	(2) Missing=10	(3) Missing=20	(4) Missing=30
1906 Loss Margin	-0.368***	-0.341***	-0.314***	-0.288***
	(0.095)	(0.090)	(0.085)	(0.081)
1900 Loss Margin	-0.102	-0.087	-0.073	-0.059
	(0.104)	(0.098)	(0.093)	(0.088)
Lagged Dependent Variable	0.204***	0.212***	0.219***	0.225***
	(0.040)	(0.039)	(0.039)	(0.038)
Adjusted R^2	0.080	0.081	0.082	0.082
N	641	641	641	641

This table replicates the baseline results assuming different percentage probabilities that the candidates who have incomplete biographical data are from the political elite, where those who have complete biographical data have their probabilities estimated by the SVM. For example, in Column 1, the dependent variable is assumed to be 0 where there is incomplete biographical data.

Table A.30 Missing Biographical Data: SVM Baseline Results - Scenario 1

	(1) Elite (LDA)	(2) Middle (LDA)	(3) Working (LDA)
1906 Loss Margin	-0.345***	0.020	0.346***
	(0.077)	(0.066)	(0.084)
1900 Loss Margin	-0.037	0.015	0.061
	(0.083)	(0.072)	(0.091)
Lagged Dependent Variable	0.329***	0.253***	0.207***
	(0.037)	(0.041)	(0.041)
Adjusted R^2	0.155	0.053	0.078
N	641	641	641

This table replicates the baseline results assuming Scenario 1: that all of those who have incomplete biographical data are 100 percent likely to be in the working class, and 0 percent likely to be in the political elite or the middle class. Those with complete biographical have their probabilities calculated by the LDA, as in the main paper.

Table A.31 Missing Biographical Data: SVM Baseline Results - Scenario 2

	(1) Elite (LDA)	(2) Middle (LDA)	(3) Working (LDA)
1906 Loss Margin	-0.345***	0.045	0.317***
	(0.077)	(0.063)	(0.077)
1900 Loss Margin	-0.037	0.025	0.044
	(0.083)	(0.068)	(0.084)
Lagged Dependent Variable	0.329***	0.269***	0.224***
	(0.037)	(0.040)	(0.040)
Adjusted R^2	0.155	0.063	0.084
N	641	641	641

This table replicates the baseline results assuming Scenario 2: that all of those who have incomplete biographical data are 90 percent likely to be in the working class, 10 percent likely to be in the middle class, and 0 percent likely to be in the political elite. Those with complete biographical have their probabilities calculated by the LDA, as in the main paper.

Table A.32 Missing Biographical Data: SVM Baseline Results - Scenario 3

	(1) Elite (LDA)	(2) Middle (LDA)	(3) Working (LDA)
1906 Loss Margin	-0.319***	0.045	0.289***
	(0.073)	(0.063)	(0.070)
1900 Loss Margin	-0.025	0.025	0.027
	(0.079)	(0.068)	(0.076)
Lagged Dependent Variable	0.346***	0.269***	0.243***
	(0.036)	(0.040)	(0.039)
Adjusted R^2	0.164	0.063	0.092
N	641	641	641

This table replicates the baseline results assuming Scenario 3: that all of those who have incomplete biographical data are 80 percent likely to be in the working class, 10 percent likely to be in the middle class, and 10 percent likely to be in the political elite. Those with complete biographical have their probabilities calculated by the LDA, as in the main paper.

Table A.33 Missing Biographical Data: SVM Baseline Results - Scenario 4

	(1) Elite (LDA)	(2) Middle (LDA)	(3) Working (LDA)
1906 Loss Margin	-0.319***	0.069	0.262***
	(0.073)	(0.060)	(0.064)
1900 Loss Margin	-0.025	0.035	0.012
	(0.079)	(0.065)	(0.070)
Lagged Dependent Variable	0.346***	0.281***	0.264***
	(0.036)	(0.040)	(0.039)
Adjusted R^2	0.164	0.073	0.101
N	641	641	641

This table replicates the baseline results assuming Scenario 4: that all of those who have incomplete biographical data are 70 percent likely to be in the working class, 20 percent likely to be in the middle class, and 10 percent likely to be in the political elite. Those with complete biographical have their probabilities calculated by the LDA, as in the main paper.

Uncontested Elections

The baseline analysis in the main paper excludes observations where the Conservative candidate in either the 1900 or the 1906 election ran uncontested, as the 1900 Loss Margin and the 1906 Loss Margin are not unambiguously defined. As a robustness check, I reproduce the baseline results in Table 1.2, but also code 1900 and 1906 Loss Margins as -100 if the Conservative candidate ran unopposed (a 100 per cent majority), and 100 if no Conservative candidate ran. The results are reported in Table A.34. Although the magnitudes are a little smaller than in the main analysis, they still provide significant evidence of an association between a greater loss margin and switching candidates from the political elite to the working class.

Table A.34 Baseline Results: Including Uncontested Elections

	(1) Elite (SVM)	(2) Elite (LDA)	(3) Middle (LDA)	(4) Working (LDA)
1906 Loss Margin	-0.102*	-0.110**	0.026	0.081*
	(0.062)	(0.056)	(0.048)	(0.041)
1900 Loss Margin	-0.022	-0.057**	0.061***	-0.001
	(0.028)	(0.026)	(0.022)	(0.019)
Lagged Dependent Variable	0.355***	0.488***	0.465***	0.439***
	(0.034)	(0.032)	(0.035)	(0.031)
Adjusted R^2	0.133	0.260	0.211	0.208
N	744	744	744	744

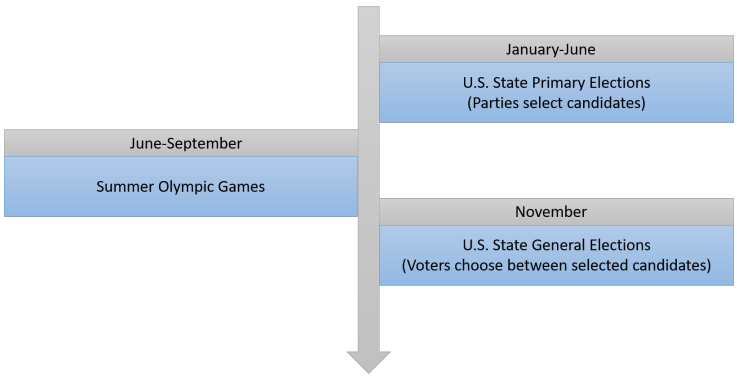
This table replicates the baseline results in the main paper, but assumes that the loss margin in an election where the Conservative Party ran unopposed is -100, and 100 if the Conservative Party did not run at all.

Appendix B

Appendix for Chapter 2

B.1 Institutional Context

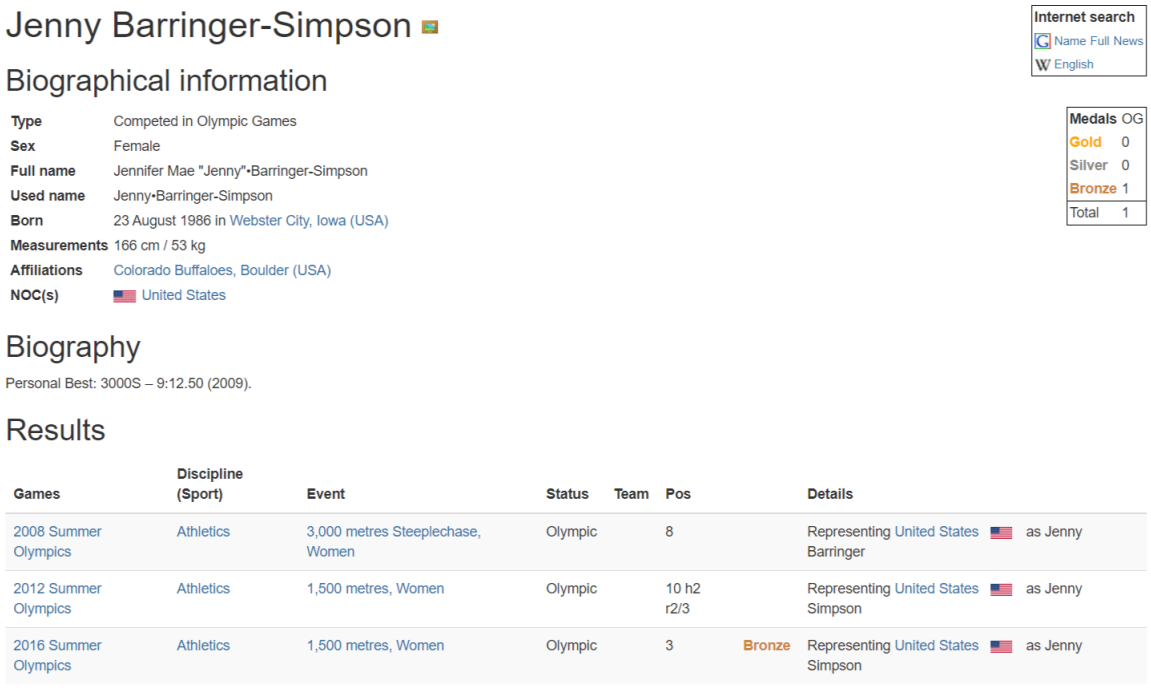
Fig. B.1 Localised Attention of Female Medallists, 2016 Olympics



B.2 Data Summary and Sources

B.2.1 Olympic Medals

Fig. B.2 Olympic Medal Data Example



Jenny Barringer-Simpson

Internet search
Name Full News
English

Biographical information

Type	Competed in Olympic Games
Sex	Female
Full name	Jennifer Mae "Jenny"•Barringer-Simpson
Used name	Jenny•Barringer-Simpson
Born	23 August 1986 in Webster City, Iowa (USA)
Measurements	166 cm / 53 kg
Affiliations	Colorado Buffaloes, Boulder (USA)
NOC(s)	United States

Medals	OG
Gold	0
Silver	0
Bronze	1
Total	1

Biography

Personal Best: 3000S – 9:12.50 (2009).

Results

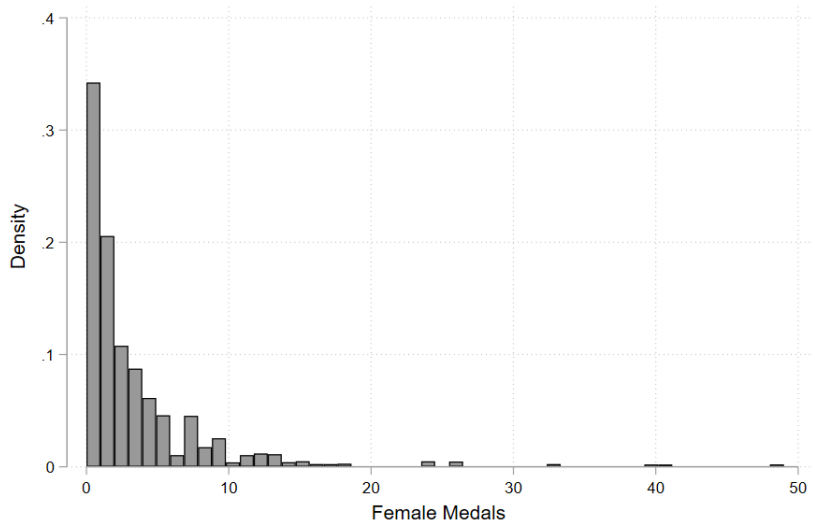
Games	Discipline (Sport)	Event	Status	Team	Pos		Details
2008 Summer Olympics	Athletics	3,000 metres Steeplechase, Women	Olympic		8		Representing United States as Jenny Barringer
2012 Summer Olympics	Athletics	1,500 metres, Women	Olympic		10 h2 r2/3		Representing United States as Jenny Simpson
2016 Summer Olympics	Athletics	1,500 metres, Women	Olympic		3	Bronze	Representing United States as Jenny Simpson

Notes: This figure presents an example of information provided about US Olympians, as presented on *olympedia.org*

B.3 Variation in Female Medals

This section outlines the variation in medals won by women across the U.S. states and across Summer Olympic Games, from 1968 to 2016. Figure B.3 illustrates the positive skew in the distribution of medals won by women across states and Olympic Games. Figures B.4, B.5, B.6, B.7, and B.8 show the variation in female medals across time for each of the 50 states.

Fig. B.3 Distribution of Female Medals across State-Olympic Pairs



Notes: This figure illustrates the distribution of medals won by women born from a state across state-Olympic pairs. This includes all states from 1968 to 2016.

Fig. B.4 Number of Medals won by Women from the State between the 1968 and 2016 Summer Olympic Games (Alabama-Georgia)

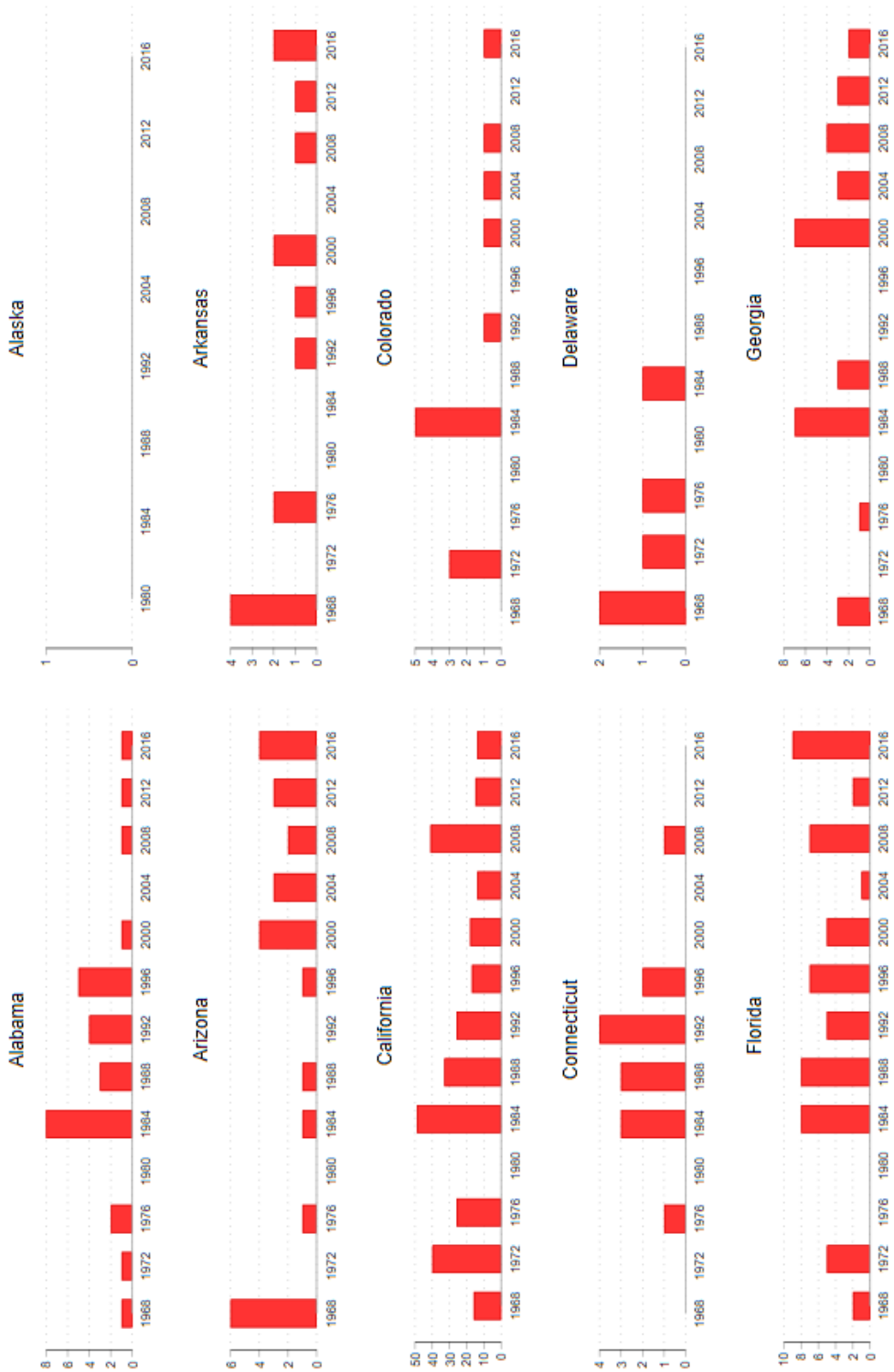


Fig. B.5 Number of Medals won by Women from the State between the 1968 and 2016 Summer Olympic Games (Hawaii-Maryland)

Fig. B.6 Number of Medals won by Women from the State between the 1968 and 2016 Summer Olympic Games (Massachusetts-New Jersey)

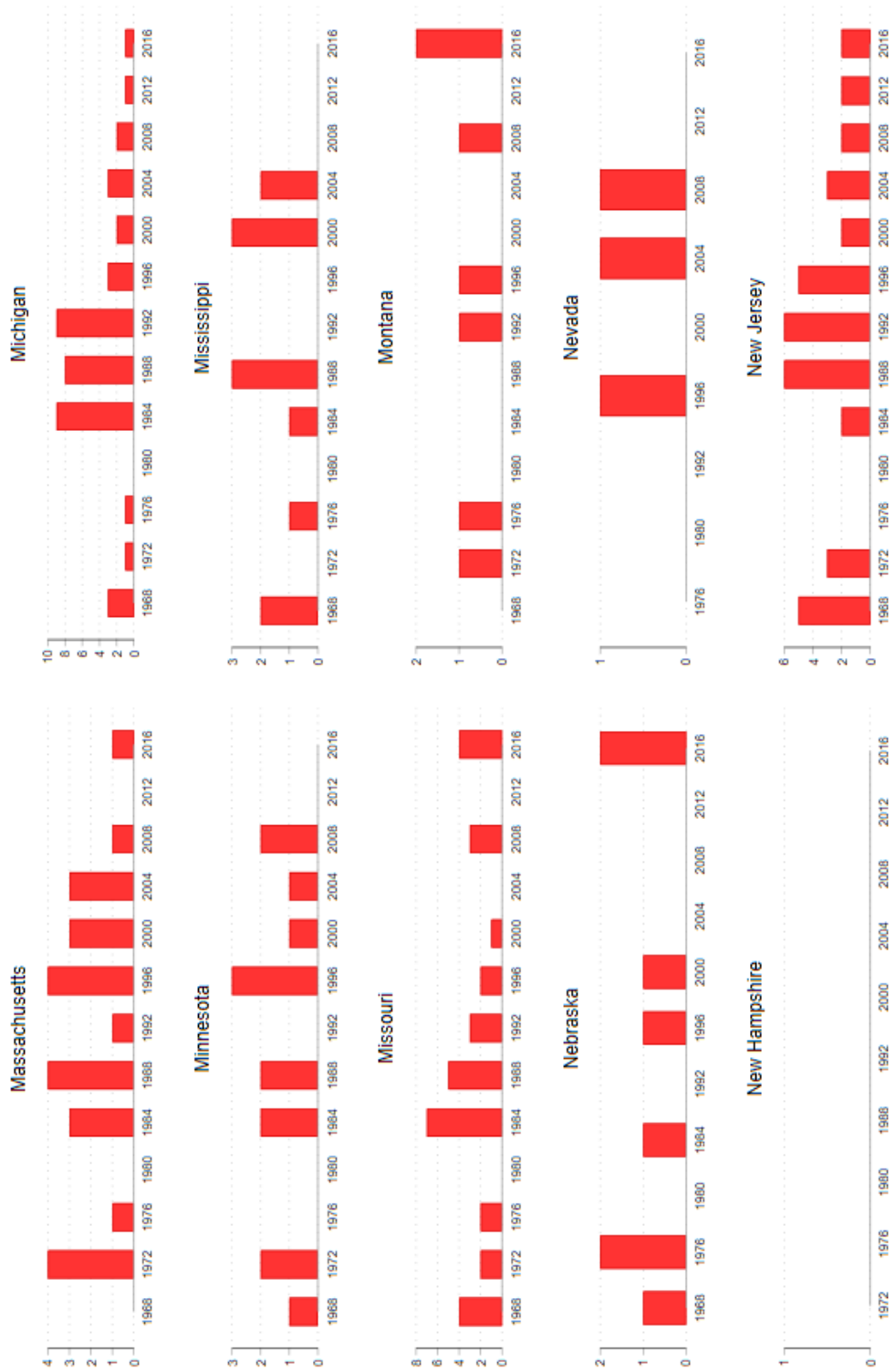
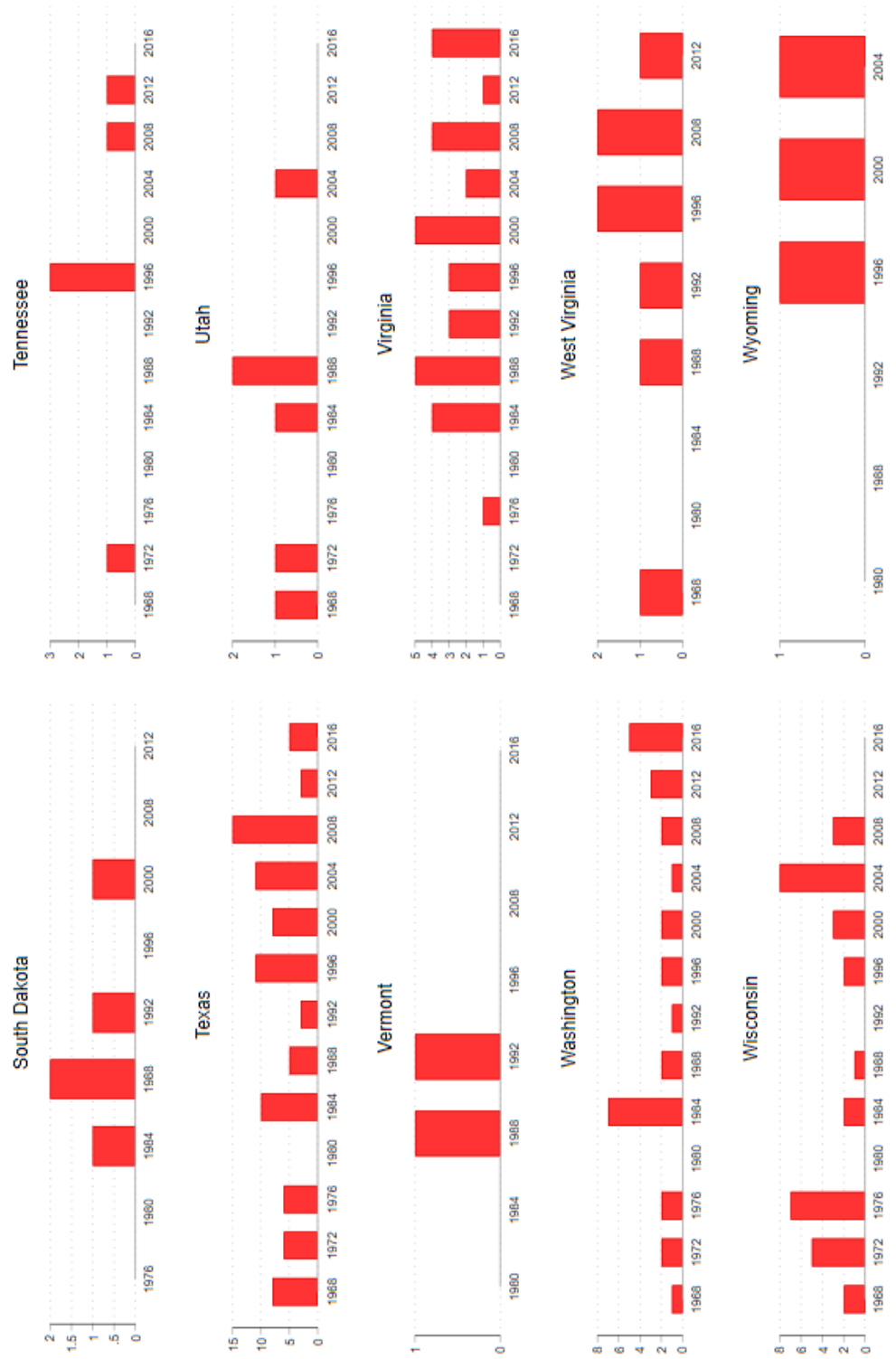


Fig. B.7 Number of Medals won by Women from the State between the 1968 and 2016 Summer Olympic Games (New Mexico-South Carolina)

Fig. B.8 Number of Medals won by Women from the State between the 1968 and 2016 Summer Olympic Games (South Dakota-Wyoming)



B.4 Persistence of Female Medal Effect

Table B.1 Persistence: Female Medal Effect Two Year Later

	(1)	(2)	(3)	(4)
Female Medals (State)	0.270	0.152	0.243	0.126
	(0.169)	(0.162)	(0.163)	(0.156)
Female Medals > 0 (State)			1.268	1.218
			(1.699)	(1.711)
Female Competitors (State)	-0.0782	0.00305	-0.0666	0.0142
	(0.152)	(0.111)	(0.154)	(0.113)
Incumbent		16.44***		16.45***
		(1.473)		(1.471)
Experience, Years		0.421***		0.420***
		(0.0915)		(0.0917)
Democrat Candidate		4.672***		4.665***
		(1.109)		(1.110)
District Fixed Effects	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y
Controls	N	Y	N	Y
Adjusted R^2	0.494	0.601	0.494	0.601
Observations	15208	15208	15208	15208

Notes: This table reports the estimates using the specification outlined in (2.1), but on female candidate votes shares in elections two years after the Olympics. The unit of observation is the female candidate-election. The dependent variable is the votes won by the female candidate as a percentage of total votes cast in the election in the district. Female Medals is the number of medals won in the summer two years before the election by women who were born in the state that the district is in, while Female Competitors is the number of female competitors who were born in the state that the district is in. Female Medals > 0 is a dummy variable that takes a value of one if at least one woman from the state won a medal in the summer two years before the election, and zero otherwise. Incumbent, Democrat Candidate, and Olympic Year are dummy variables that take value one if the candidate is an incumbent legislator, a candidate selected by the Democrat party, and whether the election is held in an Olympic year, respectively, and zero otherwise. Experience, Years is the number of years that the candidate has been a member of the legislature (which may also include years in another chamber within the legislature). All specifications include district and year fixed effects, while standard errors are clustered at the state level and are reported in parentheses. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

B.5 Male Medals Crowding Out Female Medals?

Table B.2 Crowing Out? Male Medals and the Female Medals Effect

	(1)	(2)	(3)	(4)
Female Medals (State)	0.213**	0.167*	0.207**	0.150*
	(0.0922)	(0.0853)	(0.0832)	(0.0806)
Female Medals (State) × Male Medals (State)	-0.00214	-0.000806	-0.00170	-0.0000105
	(0.00215)	(0.00182)	(0.00224)	(0.00195)
Female Medals > 0 (State)			0.280	0.577
			(0.622)	(0.523)
Female Medals > 0 (State) × Male Medals (State)			-0.284	-0.385
			(0.333)	(0.396)
Female Competitors (State)	-0.0727	-0.106	-0.0665	-0.0955
	(0.105)	(0.0916)	(0.106)	(0.0936)
District Fixed Effects	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y
Controls	N	Y	N	Y
Adjusted R^2	0.507	0.609	0.507	0.609
Observations	45427	45427	45427	45427

Notes: This table reports the baseline specification outlined in (2.1), and includes the interaction of the number of medals won by men from the state with the number of medals won by women. The unit of observation is the female candidate-election. The dependent variable is the votes won by the female candidate as a percentage of total votes cast in the election in the district. Female and Male Medals are the number of medals won in the summer before the election by women and men who were born in the state that the district is in, respectively, while Female Competitors is the number of female competitors who were born in the state that the district is in. Female Medals > 0 is a dummy variable that takes a value of one if at least one woman from the state won a medal in the summer before the election, and zero otherwise. Incumbent, Democrat Candidate, and Olympic Year are dummy variables that take value one if the candidate is an incumbent legislator, a candidate selected by the Democrat party, and whether the election is held in an Olympic year, respectively, and zero otherwise. Experience, Years is the number of years that the candidate has been a member of the legislature (which may also include years in another chamber within the legislature). All specifications include district and year fixed effects, while standard errors are clustered at the state level and are reported in parentheses. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

B.6 Robustness Checks

B.6.1 Omitting Large States

Table B.3 Main Results without California

	(1)	(2)	(3)	(4)
Female Medals (State)	0.228**	0.201*	0.229**	0.192*
	(0.113)	(0.106)	(0.104)	(0.102)
Female Medals > 0 (State)			-0.0202	0.139
			(0.655)	(0.528)
Female Competitors (State)	-0.0411	-0.0730	-0.0409	-0.0740
	(0.0735)	(0.0818)	(0.0756)	(0.0826)
Incumbent		15.27***		15.27***
		(1.252)		(1.252)
Experience, Years		0.548***		0.548***
		(0.0784)		(0.0785)
Democrat Candidate		5.397***		5.397***
		(1.142)		(1.142)
Olympic Year		0.0607		0.00944
		(1.244)		(1.212)
District Fixed Effects	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y
Controls	N	Y	N	Y
Adjusted R^2	0.511	0.610	0.511	0.610
Observations	44300	44300	44300	44300

Notes: This table reports the estimates using the specification outlined in (2.1). The unit of observation is the female candidate-election, but without observations from California. The dependent variable is the votes won by the female candidate as a percentage of total votes cast in the election in the district. Female Medals is the number of medals won in the summer before the election by women who were born in the state that the district is in, while Female Competitors is the number of female competitors who were born in the state that the district is in. Female Medals > 0 is a dummy variable that takes a value of one if at least one woman from the state won a medal in the summer before the election, and zero otherwise. Incumbent, Democrat Candidate, and Olympic Year are dummy variables that take value one if the candidate is an incumbent legislator, a candidate selected by the Democrat party, and whether the election is held in an Olympic year, respectively, and zero otherwise. Experience, Years is the number of years that the candidate has been a member of the legislature (which may also include years in another chamber within the legislature). All specifications include district and year fixed effects, while standard errors are clustered at the state level and are reported in parentheses. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

B.6.2 Omitting States with No Female Medallists

Table B.4 Main Results without States with No Female Medallists

	(1)	(2)	(3)	(4)
Female Medals (State)	0.218***	0.175**	0.195**	0.162**
	(0.0811)	(0.0765)	(0.0759)	(0.0719)
Female Medals > 0 (State)			0.694	0.423
			(0.649)	(0.639)
Female Competitors (State)	-0.0499*	-0.0555*	-0.0488*	-0.0544*
	(0.0265)	(0.0310)	(0.0267)	(0.0311)
Incumbent		16.62***		16.62***
		(0.856)		(0.856)
Experience, Years		0.597***		0.598***
		(0.0830)		(0.0831)
Democrat Candidate		6.956***		6.956***
		(1.216)		(1.216)
Olympic Year		2.842***		2.599**
		(0.992)		(1.176)
District Fixed Effects	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y
Controls	N	Y	N	Y
Adjusted R^2	0.482	0.606	0.482	0.606
Observations	38432	38432	38432	38432

Notes: This table reports the estimates using the specification outlined in (2.1). The unit of observation is the female candidate-election, but excludes states from which no woman ever wins a medal in the sample. The dependent variable is the votes won by the female candidate as a percentage of total votes cast in the election in the district. Female Medals is the number of medals won in the summer before the election by women who were born in the state that the district is in, while Female Competitors is the number of female competitors who were born in the state that the district is in. Female Medals > 0 is a dummy variable that takes a value of one if at least one woman from the state won a medal in the summer before the election, and zero otherwise. Incumbent, Democrat Candidate, and Olympic Year are dummy variables that take value one if the candidate is an incumbent legislator, a candidate selected by the Democrat party, and whether the election is held in an Olympic year, respectively, and zero otherwise. Experience, Years is the number of years that the candidate has been a member of the legislature (which may also include years in another chamber within the legislature). All specifications include district and year fixed effects, while standard errors are clustered at the state level and are reported in parentheses. ***, **, and * denote statistical significance at 1, 5, and 10 percent level, respectively.

Appendix C

Appendix for Chapter 3

C.1 First-Stage Regressions

Table C.1 First-Stage Regression

	Dependent variable:				
	Female Proportion of Winners				
	(1)	(2)	(3)	(4)	(5)
Panel A: District Level					
Female Close Winners	0.971***	0.999***	1.027***	1.013***	0.989***
	(0.007)	(0.010)	(0.016)	(0.023)	(0.032)
Bandwidth (+/-)	10 percent	5 percent	2 percent	1 percent	0.5 percent
F-Statistic	210.16	146.66	106.8	91.28	83.96
Observations	143,149	143,149	143,149	143,149	143,149
Adjusted R^2	0.126	0.092	0.068	0.059	0.054
Panel B: State Chamber Level					
Female Close Winners	0.845***	0.985***	0.931***	1.007***	1.072***
	(0.099)	(0.140)	(0.139)	(0.222)	(0.252)
Bandwidth (+/-)	10 percent	5 percent	2 percent	1 percent	0.5 percent
F-Statistic	40.14	38.84	36.35	35.9	35.53
Observations	2,290	2,290	2,290	2,290	2,290
Adjusted R^2	0.715	0.708	0.694	0.691	0.689

Notes: This table reports estimates from the first-stage specification. The unit of observation in Panel. A is the district-election, while in Panel B it is the state chamber-election. The dependent variable is the number of women elected divided by the total number elected. The explanatory variable is the constructed instrument: Net Close Female Winners. Column 1 assumes that the definition of a small margin is 10 percent of total votes cast, 5 percent for Column 2, 2 percent for Column 3, 1 percent for Column 4, and 0.5 percent for Column 5. All specifications included year and state fixed effects. Standard errors, which are clustered at the district level in Panel A and at the state chamber level in Panel B, are reported in parentheses. Significance levels are denoted as follows: *p<0.1; **p<0.05; ***p<0.01

C.2 Regression Tables

Table C.2 Impact on Female Representation Across Future Elections

	Dependent variable:			
	Outcome (t+1)	Outcome (t+2)	Outcome (t+3)	Outcome (t+4)
	(1)	(2)	(3)	(4)
Panel A: Female Proportion of Future Candidates				
Female Winners	0.240***	0.155***	0.128**	0.279***
	(0.036)	(0.047)	(0.061)	(0.080)
Bandwidth (+/-)	0.5 percent	0.5 percent	0.5 percent	0.5 percent
Observations	206,154	129,648	70,353	33,303
Adjusted R^2	0.033	0.026	0.023	0.019
Panel B: Female Proportion of Future Winners				
Female Winners	0.444***	0.304***	0.195**	0.489***
	(0.056)	(0.068)	(0.093)	(0.126)
Bandwidth (+/-)	0.5 percent	0.5 percent	0.5 percent	0.5 percent
Observations	111,483	70,173	38,342	17,713
Adjusted R^2	0.043	0.035	0.028	0.024

Notes: This table reports the estimated impact of the election of a woman in a district on female. representation in the district in the following four elections. The unit of observation is the candidate-district-election. The dependent variable is a binary variable that takes a value of one if the candidate is a woman, and a value of zero otherwise. The specifications in Panel A include all candidates, whereas in Panel B the sample is reduced to candidates who are elected into office at that election. Column 1 reports the estimated effect on the next election, Column 2 the impact on the second election after the treatment, and so on. All specifications included year and state fixed effects. Standard errors, which are clustered at the district level, are reported in parentheses. Significance levels are denoted as follows: *p<0.1; **p<0.05; ***p<0.01

Table C.3 Impact on Female Candidacy (New Candidates)

	Dependent variable:			
	Female Candidate (t+1)	Female Candidate (t+2)	Female Candidate (t+3)	Female Candidate (t+4)
	(1)	(2)	(3)	(4)
Panel A: Future Female Proportion of Candidates (New Candidates)				
Female Winners	-0.231^{***}	0.034	0.010	0.213^{**}
	(0.044)	(0.057)	(0.073)	(0.091)
Bandwidth (+/-)	0.5 percent	0.5 percent	0.5 percent	0.5 percent
Observations	117,801	73,548	39,500	19,033
Adjusted R^2	0.030	0.024	0.020	0.020
Panel B: Future Female Proportion of Winners (New Candidates)				
Female Winners	-0.351^{***}	0.156	0.008	0.714^{***}
	(0.086)	(0.121)	(0.153)	(0.220)
Bandwidth (+/-)	0.5 percent	0.5 percent	0.5 percent	0.5 percent
Observations	28,706	17,316	9,327	4,385
Adjusted R^2	0.034	0.021	0.009	0.002

Notes: This table reports the estimated impact of the election of a woman in a district on female. representation in the district in the following four elections. The unit of observation is the candidate-district-election. The dependent variable is a binary variable that takes a value of one if the candidate is a woman, and a value of zero otherwise. The specifications in Panel A include candidates who are not incumbents in the chamber, whereas in Panel B the sample further restricts the sample to candidates who are not incumbents and are elected at that election. Column 1 reports the estimated effect on the next election, Column 2 the impact on the second election after the treatment, and so on. All specifications included year and state fixed effects. Standard errors, which are clustered at the district level, are reported in parentheses. Significance levels are denoted as follows: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table C.4 Geographical Spillovers

	Dependent variable:			
	Outcome (t+1)	Outcome (t+2)	Outcome (t+3)	Outcome (t+4)
	(1)	(2)	(3)	(4)
Panel A: Future Female Proportion of Candidates (All Candidates)				
Female Winners	0.759***	0.746***	0.740***	0.699***
	(0.038)	(0.038)	(0.045)	(0.046)
Bandwidth (+/-)	0.5 percent	0.5 percent	0.5 percent	0.5 percent
Observations	285,162	271,629	258,076	244,413
Adjusted R^2	0.036	0.032	0.029	0.027
Panel B: Future Female Proportion of Candidates (New Candidates)				
Female Winners	0.548***	0.537***	0.504***	0.489***
	(0.056)	(0.056)	(0.060)	(0.056)
Bandwidth (+/-)	0.5 percent	0.5 percent	0.5 percent	0.5 percent
Observations	166,690	158,304	149,684	141,241
Adjusted R^2	0.032	0.029	0.027	0.025
Panel C: Future Female Proportion of Winners (All Candidates)				
Female Winners	1.010***	0.990***	1.009***	0.941***
	(0.014)	(0.021)	(0.030)	(0.043)
Bandwidth (+/-)	0.5 percent	0.5 percent	0.5 percent	0.5 percent
Observations	153,401	146,270	139,113	132,073
Adjusted R^2	0.048	0.043	0.038	0.035
Panel D: Future Female Proportion of Winners (New Candidates)				
Female Winners	0.803***	0.792***	0.771***	0.754***
	(0.047)	(0.050)	(0.051)	(0.057)
Bandwidth (+/-)	0.5 percent	0.5 percent	0.5 percent	0.5 percent
Observations	42,991	40,532	37,781	35,363
Adjusted R^2	0.039	0.032	0.026	0.024

Notes: This table reports the estimated impact of the election of women in the chamber on female. representation in future elections. The unit of observation is the candidate-district-election. The dependent variable is a binary variable that takes a value of one if the candidate is a woman, and a value of zero otherwise. The specifications in Panel A include all candidates, Panel B includes all candidates who are not incumbents, whereas in Panel C the sample is restricted to candidates who are elected into office at that election, and Panel D includes canddiates who are elected into office and are not incumbents when they run. Column 1 reports the estimated effect on the next election, Column 2 the impact on the second election after the treatment, and so on. All specifications included year and state fixed effects. Standard errors, which are clustered at the state chamber level, are reported in parentheses. Significance levels are denoted as follows: *p<0.1; **p<0.05; ***p<0.01

Table C.5 Impact by Political Party

	Dependent variable:			
	Outcome (t+1)	Outcome (t+2)	Outcome (t+3)	Outcome (t+4)
	(1)	(2)	(3)	(4)
Panel A: Future Female Democrat Candidates				
Female Winners	0.214***	0.124	0.163*	0.318**
	(0.061)	(0.076)	(0.093)	(0.144)
Bandwidth (+/-)	0.5 percent	0.5 percent	0.5 percent	0.5 percent
Observations	95,227	59,826	32,430	14,832
Adjusted R^2	0.062	0.053	0.045	0.037
Panel B: Future Female Republican Candidates				
Female Winners	0.330***	0.214***	0.105	0.299***
	(0.056)	(0.065)	(0.078)	(0.107)
Bandwidth (+/-)	0.5 percent	0.5 percent	0.5 percent	0.5 percent
Observations	85,527	53,994	29,754	14,044
Adjusted R^2	0.018	0.012	0.009	0.006
Panel C: Future Female Democrat Winners				
Female Winners	0.360***	0.190*	0.246*	0.546***
	(0.085)	(0.112)	(0.137)	(0.210)
Bandwidth (+/-)	0.5 percent	0.5 percent	0.5 percent	0.5 percent
Observations	61,062	38,357	20,737	9,256
Adjusted R^2	0.077	0.067	0.058	0.052
Panel D: Future Female Republican Winners				
Female Winners	0.240***	0.224***	0.138	0.192
	(0.036)	(0.065)	(0.122)	(0.159)
Bandwidth (+/-)	0.5 percent	0.5 percent	0.5 percent	0.5 percent
Observations	206,154	30,890	13,866	5,325
Adjusted R^2	0.033	0.040	0.036	0.023

Notes: This table reports the estimated impact of the election of a woman in a district on female. representation in the district in the following four elections, split by political party. The unit of observation is the candidate-district-election. The dependent variable is a binary variable that takes a value of one if the candidate is a woman, and a value of zero otherwise. The specifications in Panel A include all Democrat candidates, whereas in Panel B the sample is reduced to Democrat candidates who are elected into office at that election. Panel C includes all Republican candidates, and Panel D includes all Republican candidates who are elected into office at that election. Column 1 reports the estimated effect on the next election, Column 2 the impact on the second election after the treatment, and so on. All specifications included year and state fixed effects. Standard errors, which are clustered at the district level, are reported in parentheses. Significance levels are denoted as follows: *p<0.1; **p<0.05; ***p<0.01